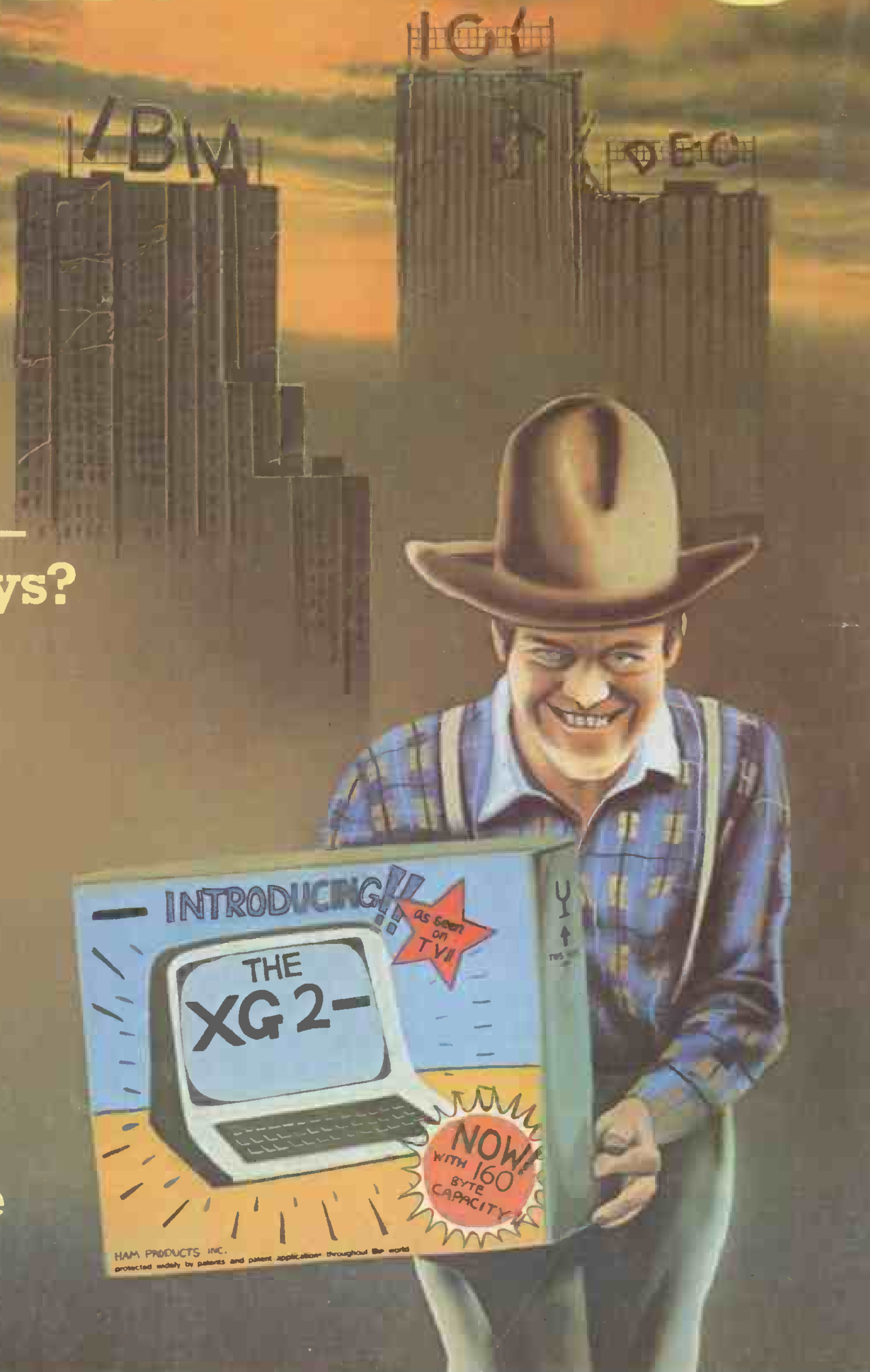
80p

Practical Computing

May 1982 Volume 5 Issue 5



Fall of the giants — rise of the Cowboys?

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Genie I
MBasic
SuperCalc

Whitehall game

Atom assembler

Pet machine-code subroutines

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Fall of the giants — page 84

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2564	£20
2708	200
2716-5V	210
2732-450n	400
2764	£17
4027	240
4116-150n	95
4116-200n	80
4118-250	400
4164-200	620
4315-4K	795
4334-3 (CMOS2114)	325
4816A-120n	250
5101	270
4864-3	785
6116-150nS	450
6502-CPU	399
6503	600
6504-250	550
6505	600
6521	150
6522 VIA	350
6530 RR10T	12
6532 R10T	625
6545 CRTC	10
6551 ACIA	650
6592-PC	£20
6800	300
6802	400
6803	850
6804	160
6805	670
6808	520
6809	999
6810	120
6821	125
6840	412
6843	12
6845	750
6847	850
6850	140
6852	255
6875	500
8080A	350
8085A	550
81LS95	90
81LS96	90
81LS97	90
8123	125
8155	475
8202	£25
8212	170
8214	425
8216	70
8224	200
8226	250
8228	250
8251	320
8253	799
8255	295
8257	800
8T26A	99
8T27	150
8T28A	115
8T31	350
8T95N	99
8T97N	99
9364AP	550
AM26L531C	125
AM26L532A	125
AY-3-1015	300
AY-3-8910	600
AY-3-8912	625
AY-5-1013	300
AY-5-2376	600
FD1771	£18
FD1791	28
FD1793	30
FD1795	30
FD1797	35
IM6402	380
MC1488	55
MC1489	55
MC14411	695
MC14412	795
MM5280D	695
RO-3-2513L	700
RO-3-2513L	700
RO-3-2513U	600
SFF96364E	800
TMS2716-3V	875
TMS6011	365
ULN2003	100
ULN2004	90
Z80CPU25	350
Z80ACPU4M	385
Z80P10	290
Z80AP10	320
Z80CTC	300
Z80ACTC	325
Z80DMA	10
Z80S10-1	£15
Z80AS10	£23
Z80DART	726
Z80ADART	775
ZN419CE	190
ZN423E	138
ZN424E	130
ZN425E	345
ZN426E	300
ZN427E	600
ZN428E	478
ZN429E	210
ZN1034E	200
ZN1040E	675
74S132	110
74S138	180
74S188	210
74S189	158
74S194	320
74S201	350
74S241	390
74S262	850
74S287	300
74S288	210
74S470	325
74S471	620
74S472	1150
74S475	825
74S571	620
75107	8125
75108	95
75182	99
75183	99
75154	150
75188	55
75189	55
75322	140
75450	80
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75491/2	65

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7423	22
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7438	27
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7442	38
7443	90
7444	90
7445	65
7446	55
7447	50
7448	50
7450	16
7451	16
7453	16
7454	16
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7496	45
7497	120
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74104	85
74105	65
74107	32
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74112	170
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74122	45
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74128	42
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74153	45
74154	75
74156	75
74157	45
74159	99
74160	60
74161	60
74162	62
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74164	64
74165	62
74166	65
74167	185
74170	168
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74276	150
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74283	90
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74290	105
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74298	100
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74LS

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LS12	15
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LS124	105
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LS195	40
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LS240	60
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LS243	85
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LS248	65
LS249	68
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LS253	40
LS257	48
LS258	40
LS259	85
LS261	195
LS266	25
LS273	290
LS279	88
LS280	2250
LS283	45
LS290	57
LS293	595
LS295	215
LS298	130
LS299	420
LS300	157
LS302	175
LS320	270
LS323	270
LS423	200
LS323	270
LS324	200
LS325	320
LS326	330
LS327	315
LS347	150
LS348	190
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LS3365	37
LS366	37
LS367	37
LS368	90
LS373	75
LS374	75
LS375	48
LS377	90
LS378	69
LS379	65
LS384	395
LS3385	378
LS390	62
LS393	60
LS395	199
LS445	140
LS471	620
LS490	245
LS541	135
LS640	226
LS641	225
LS645	210
LS668	175
LS669	160
LS670	550
LS674	750

CMOS

4000	14
4001	14
4002	14
4006	66
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4008	62
4008	62
4009	35
4010	40
4011	15
4012	18
4013	34
4014	75
4015	66
4017	48
4018	68
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4023	20
4024	46
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4027	38
4029	77
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4031	170
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4034	195
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4059	480
4060	90
4061	1225
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4063	99
4066	36
4067	399
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4070	26
4071	20
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4075	20
4076	60
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4078	26
4081	26
4082	21
4085	65
4086	70
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4093	43
4094	68
4095	90
4096	90
4097	320
4098	88
4099	95
4160	95
4161	99
4162	99
4163	99
4174	99
4175	105
4194	105
4408	790
4409	790
4410	725
4411	695
412	800
4415	480
44419	280
4422	770
4433	770
4435	850
4440	999
4450	850
4451	350
4490	350
4500	675
4501	28
4502	90
4503	50
4504	105
4506	65
4507	40
4508	265
4510	68
4511	68
4512	75
4513	199
4514	195
4515	198
4516	75
4517	415
4518	42
4519	29
4520	78
4521	200
4522	125
4526	95
4527	115
4528	80
4529	150
4530	90
4531	130
4532	110
4534	500
4536	295
4538	115
4539	115
4541	140
4543	135
4544	150
4549	395
4553	299
4554	190
4555	50
4556	55
4557	320
4558	120
4559	395
4560	180
4561	104
4562	495
4566	175
4568	260
4569	175
4572	36
4580	460
4581	250
4582	99
4583	99
4584	48
4585	99
4597	330
4598	290
4599	595
40097	88
40100	215
40101	130
40102	180
40103	175
40104	95
40105	115
40106	75
40107	60
40108	450
40109	100
40110	300
40114	240
40163	108
40193	108
45106	595

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2732	400p	375p
4116	75p	68p
4334-3	325p	290p
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Stack Pack Unit incl. 10 C12 Cassettes 550p

CRYSTALS

32.768KH	100
100KHz	270
200KHz	295
455KHz	375
1MHz	295
1.008M	290
1.6MHz	392
1.8MHz	395
1.843M	220
2.0MHz	240
2.4576M	220
3.2768M	150
3.57594M	98
3.6864M	300
4.0MHz	150
4.032M	290
4.80MHz	200
4.1943M	200
4.433619	120
5.0MHz	160
5.185M	300
5.24288	390
6.0MHz	140
6.144MHz	225
6.5536M	200
7.0MHz	150
7.168MHz	160
7.68MHz	200
8.0MHz	150
8.08333	395
8.867237	175
9.0MHz	200
9.375M	350
10.0MHz	175
10.7MHz	150
10.24MHz	200
12.0MHz	290
12.528M	300
14.31818	170
16.0MHz	250
18.0MHz	180
18.432M	150
19.968M	150
20.0MHz	325
24.0MHz	170
24.930M	325
26.69M	150
26.67M	325
27.125M	295
27.145M	190
38.6667	175
48.0M	175
100.0M	375
116.0M	300

IDC CONNECTORS

(Speed Block type)	PCB Plug with latch Pins Strt	PCB Plug with latch Pins Angle	Hdr Free Skt.	PCB Strt	Pins Angle
2x5 way	90p	99p	85p	60p	65p
2x8 way	130p	150p	110p	70p	78p
2x10 way	145p	166p	125p	80p	92p
2x13 way	175p	200p	150p	95p	110p
2x17 way	205p	236p	160p	110p	135p
2x20 way	220p	250p	190p	125p	150p
2x25 way	235p	270p	200p	150p	175p

JUMPER LEADS: Ribbon Cable Assembly DIL PLug (Headers)

Single Ended Lead, 24" Long

Length	14pin	16pin	24pin	40pin
24"	145p	165p	240p	380p

Double Ended Leads

	14pin	16pin	24pin	40pin
6"	185p	205p	300p	465p
12"	198p	215p	315p	490p
24"	210p	235p	345p	540p
36"	230p	250p	375p	595p

ID Header Socket Jumper Leads 24"

	20pin	26pin	34pin	40pin
1 end	160p	200p	260p	300p
2 ends	290p	370p	480p	525p

RIBBON CABLE

Ways	Grey Price foot	Colour Price foot
10	12p	22p
20	25p	40p
26	35p	52p
40	55p	70p

DIL PLUGS (Headers)

	Sldr	IDC
14pin	44p	100p
16pin	49p	120p
24pin	88p	170p
40pin	250p	265p

AMPHENOL PLUGS

24way IEEE 5/5p
34 way Centronics Parallel 550p

ZIF DIL SOCKETS

24way	575p
28way	850p
40way	975p

VIC 20

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DIL SOCKETS

	Low Prof	Wire Wrap
8pin	8p	25p
14pin	10p	35p
16pin	10p	42p
18pin	16p	52p
20pin	22p	60p
22pin	25p	70p
24pin	25p	70p
28pin	28p	80p
40pin	30p	99p

EDGE CONNECTORS

(Double type)	.1"	.156"
2x10way	—	135p
2x15way	—	140p
2x18way	180p	145p
2x22way	199p	200p
2x23way	210p	—
2x25way	225p	—
2x30way	245p	—
2x36way	295p	—
2x40way	315p	—
2x43way	395p	—
2x75way	550p	—

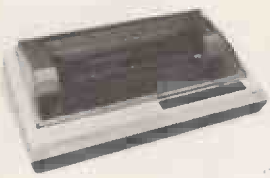
'D' CONNECTORS Mini (Solder Bucket)

Ways	Plug	Socket	Cover
9	55p	110p	100p
15	130p	160p	98p
25	160p	210p	95p
37	250p	350p	135p
Right Angle PCB Pins			
25	210p	275p	95p

● Circle No. 102

PRINTERS

SEIKOSHA GP100



New Design unbelievably low price printer

80 columns. 30 cps 5 x 7 dot matrix. Adjustable tractor up to 10 ins. Graphics. double & standard width printing. Parallel interface as standard. RS232, Apple, IEEE & TRS-80 interface options.

£215

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Probably the most popular printer in the world.

Type I: 80 cps bidirectional printing logic seeking. 9 x 9 matrix with true descenders. 3 way paper handling. 80 columns with condensed emphasised & enlarged characters. FF, VT & HT. Parallel interface.
Type II: has programmable form feed & line spacing. Bit image printing.

MX80 FT **£399** MX8 FT TYPE II **£445**

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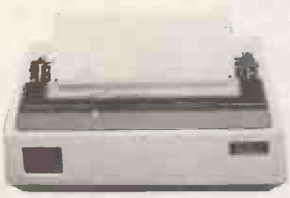

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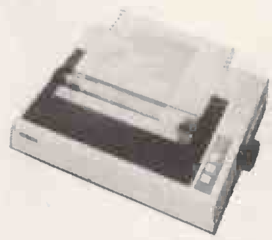

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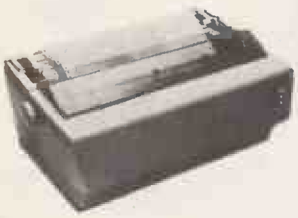

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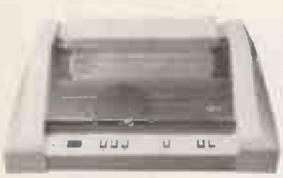

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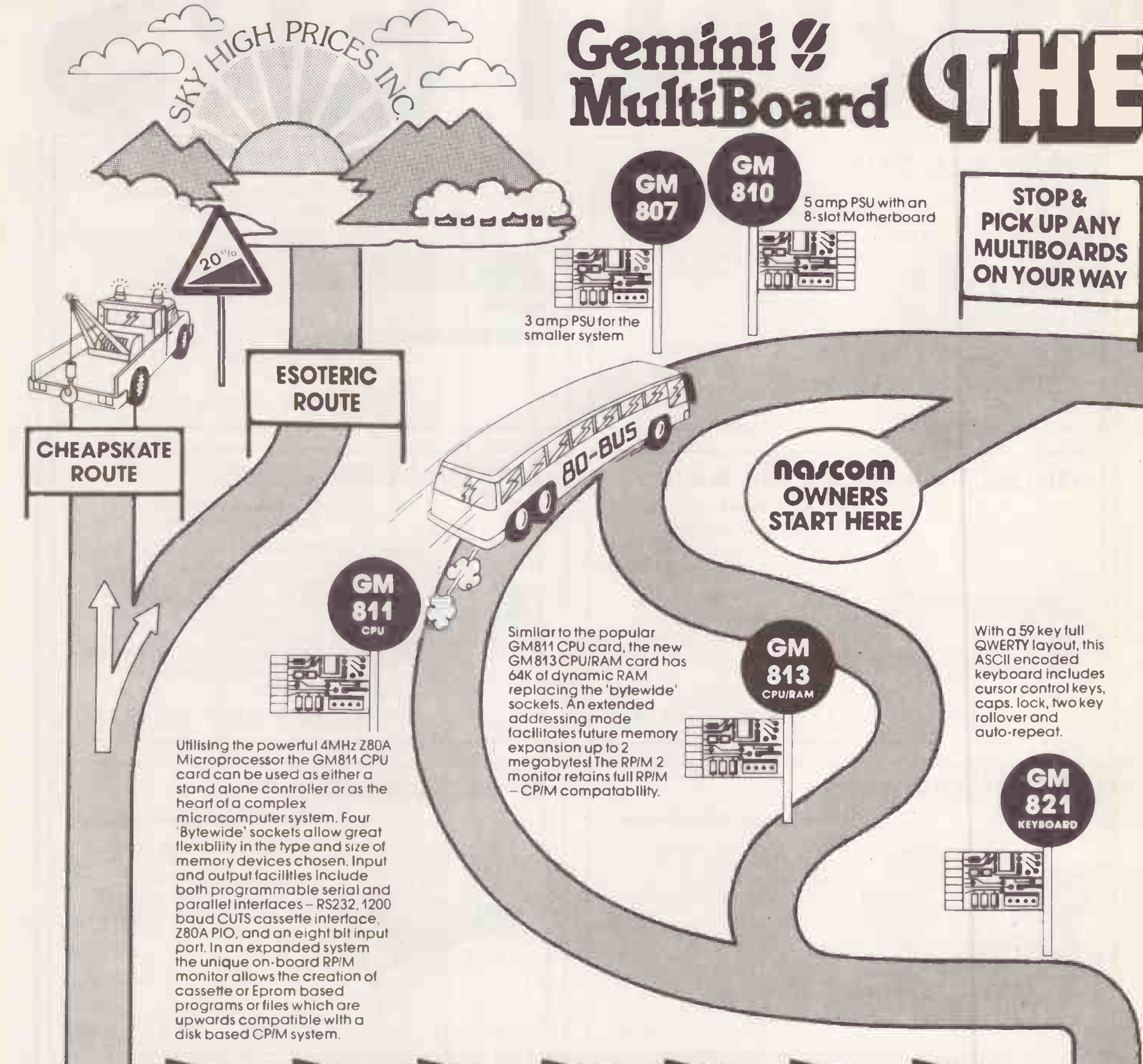

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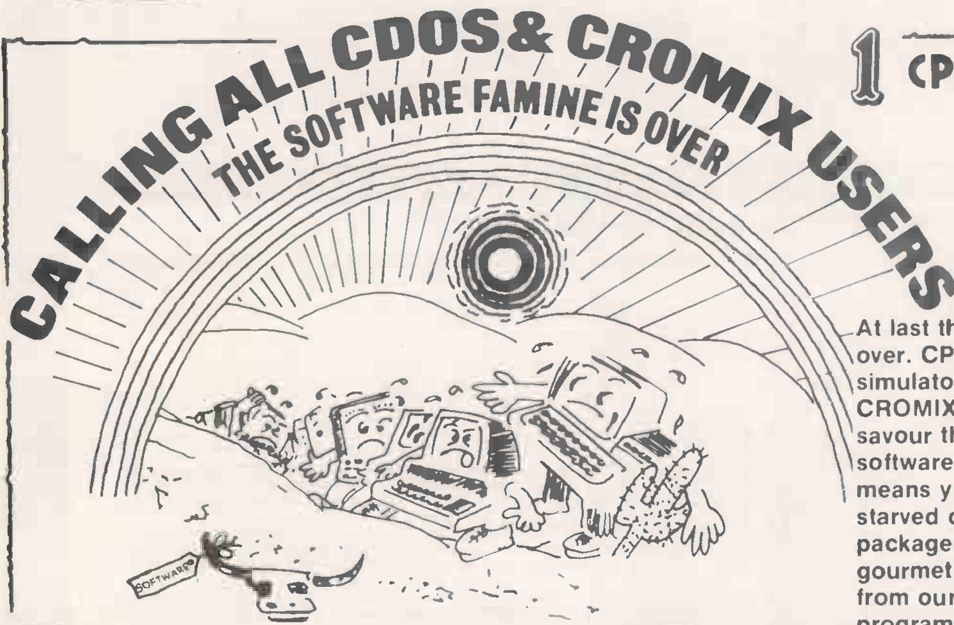

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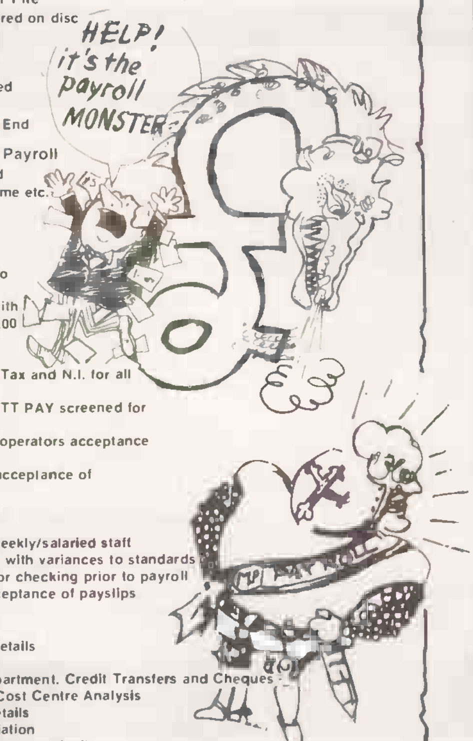

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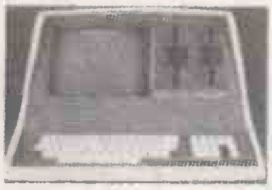

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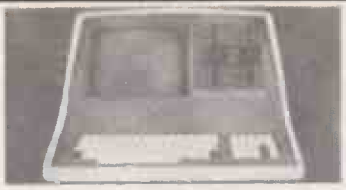

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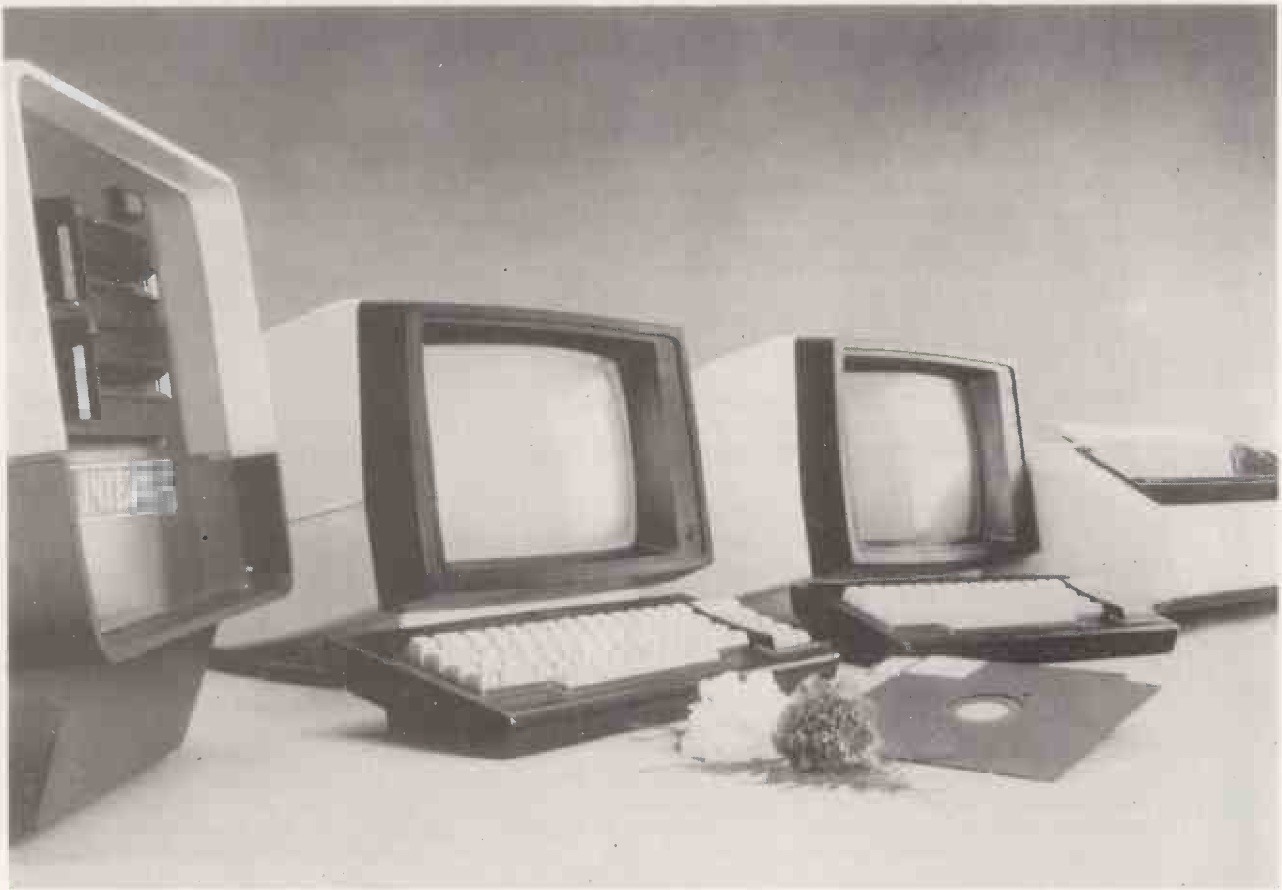

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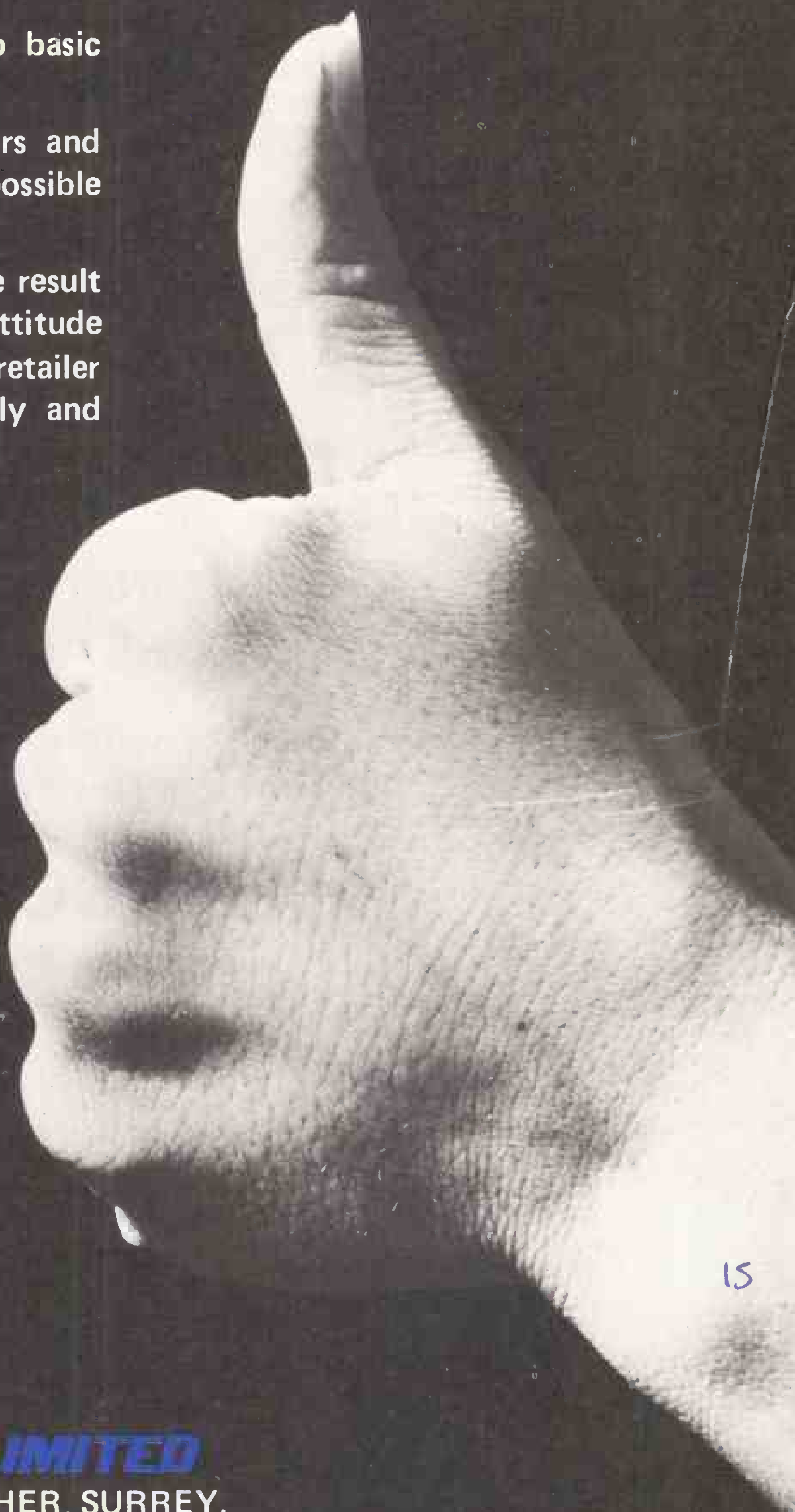

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purpose

To provide a natural, easy way for people to create custom application programs through an English language interaction with a personal computer.

Description

Personal PEARL is the natural, human way to create new computer solutions. Computers are designed to solve general problems at incredible speeds. Application programs are required to operate the computer in order to quickly solve specific human problems. Personal PEARL unlocks the power of the computer so you can resolve your unique business problems.

Personal PEARL asks you for examples of the results you require from the computer. Personal Programmer then produces the application program. Personal PEARL is for the individual who requires custom computer solutions without the cost and time delay of hiring a programmer.

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Highlights

- Interactive English program development. Menu-oriented application description speeds development via formated screens, input error checking.
- Built in HELP facility.
- Display handling is defined by using Personal PEARL convenient full-screen facilities to simply type in the display screens exactly the way they are to appear in the new program.
- Report handling is defined in the same way; by simply formatting the display screen to show the layout of the reports required by the new program.
- The application program display screens or reports may be modified at any time, or new displays or reports may be added.
- Calculation edit: arithmetic operations, editing, translation, table look up, and data validation are included.
- Data routine: display-to-display, display-to-printer, and display-to-file facilities are provided.
- Files may be quickly and easily sorted, printed, searched for selected records, reorganised or analysed.
- Display screens, files or reports may be modified to reflect changing program requirements.
- Display screens may be custom designed in any form.
- Reports may be custom designed in any form. Several report formats may be stored for later use.
- Data may be sent to SuperCalc* or Multiplan* for forecasting.
- No limitation on number of application programs (one file per application).
- Maximum file sizes determined only by the maximum capacity of the disk storage medium on the computer.
- Records may be up to several thousand characters long, if needed.
- The number of records that may be stored in a file is determined by the total file size. Records are variable length with record packing, eliminating the wasted space incurred by fixed length schemes.
- Data base support is provided by an independent data base manager.
- File support is provided through indexing and sequential data access.
- Security and Integrity of Data:
  - Data input can be validated against previously defined edit criteria before changes are made to data files.
  - Edit criteria can be modified dynamically.
- Automatic Screen Entry Message:
  - Users of Personal PEARL can establish messages to the program operator in order to direct correct data entry.
- Data File Independence:
  - The descriptions of data files are maintained in an independent description file — the dictionary.
- Multiple Program Integration
  - Several generic programs such as word processing and spread sheet analysis may be integrated through Personal PEARL.

Prerequisite Products

- CP/M Operating System
  48K RAM Microcomputer

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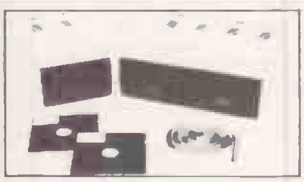

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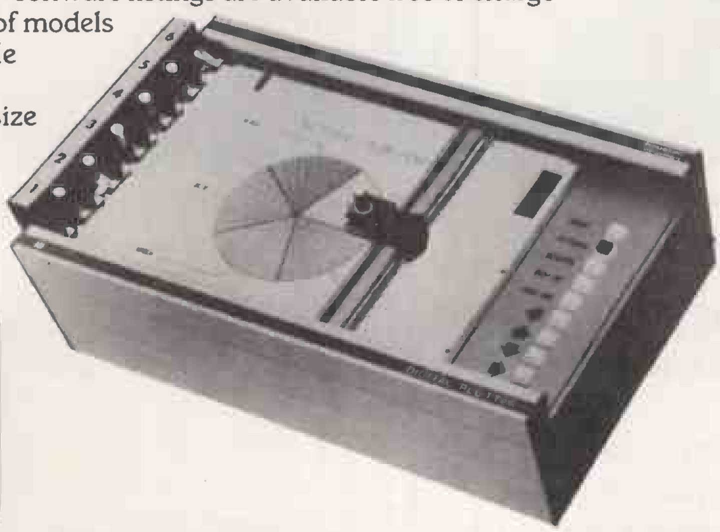

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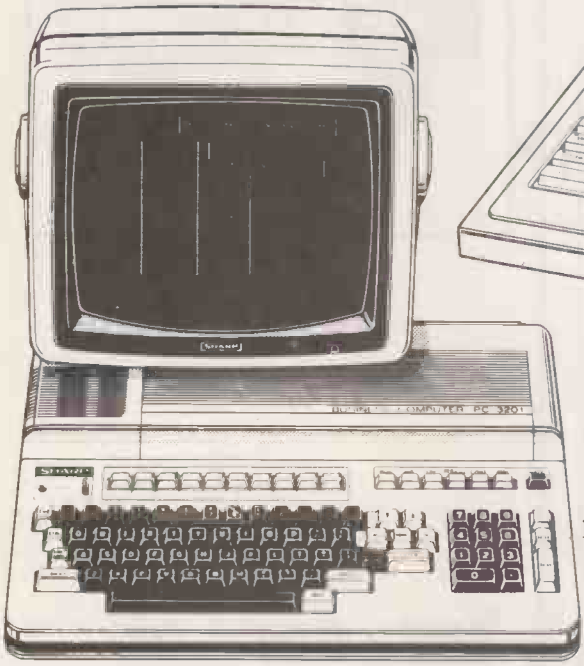

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● Circle No. 135

Hit any key to continue?

THE STORY GOES like this; there was a man selling micros and a man who might buy one. The small-business customer that every micro dealer dreams about walked in and made very hopeful noises, expressive of a desire to revolutionise his business by buying many small computers.

The man who might sell one was delighted. He produced his most expensive program, with advanced, interactive, user-friendly features and proposed to blow the potential buyer's head off with the wonderfulness of it all.

He sat there patiently while they wiggled plugs in the wall to see why the disc drive would not boot, and he made not a sign of annoyance, when young Donald, from the back room pointed out that someone had "borrowed" the computer's fuse for the kettle.

Eventually the machine was persuaded to boot and load the wonder package. It first printed up a self-satisfied account of itself and then : "Hit any key to continue?"

The customer was shown to the controls. He nodded, read the message, pulled his chair up to the table and read it again. He leaned back, crossed his legs and looked at it once more. He looked at the back of the machine — no enlightenment there. A finger hovered over the keys, but then died and lay on the desk. He rubbed his eyes, polished his glasses, shook his head. He ran his finger along the line of text:

H I T A N Y K E Y T O C O N T I N U E ?

The more he looked, the less sense it made. Was it an order? — No, it had a question mark. Was it a question? If so, what was the answer: Yes or No? Why was it asking him anyway? They said computing was not as easy as it seemed. Perhaps the machine's problem was the word "any". Surely, the key with "A" written on it produced a different effect to the key with ")", yet the question seemed to imply either that they might be the same, or that someone ill-informed might think so. Was the problem simply "hit"? Perhaps the computer had suffered some bad experiences and like a stray cat was revealing its history by cringeing as it was approached.

Or was the problem "continue"? "Do you honestly think that just by delivering random blows you can make me carry on?" It had written some tendentious nonsense on its TV screen. Did you have to believe what computers said? Were they capable of lying? Without the "?" it would make sense. It had written something and was waiting for you to read it before it "continued" — whatever that might be. But computers are infallible, so "?" must be there for a reason. Was it some sort of intelligence test? Is this the point where those who could hack the micro-revolution went on to fame and fortune and those who could not were relegated to the scrap-heap of history?

Computers are expensive and delicate. Surely you might wreck the gear if you just pressed any old key. Perhaps that was how these people made their livings: they sat innocent victims down in front of the machine, baffled them with unintelligible messages and then sent them a bill for the damage. No — that was a bit extreme. But how was one to interpret the voice of this text? Was it like a message written on a scrap of paper by someone sitting on the other side of this table? Or was it to be treated like an inscription on stone, intended for rhetorical effect only; or even like writing in the clouds — a freak of nature interesting only because it looks so much like writing?

The potential customer stood up, picked up his briefcase and walked out without a word. Young Donald leaned over and hit any key. The machine wrote: "Disc Error".

We all know what happened. The programmer could not be bothered to write a proper input routine and just made do with Input and a prompt string. Input helpfully puts up a "?", but we are all so used to it that we do not notice.

We are at a tricky stage, when the people who have to embrace the new era are completely baffled by computers. They come to the machines with completely unrealistic expectations. They have no solid mental models of what a computer can and cannot do. They feel anxious and insecure about using a machine they do not understand.

Unfortunately, although this uncertainty is widespread, we are now expecting people to gut their businesses and hurl the entrails into silicon. The problem cannot be concealed under a thin dressing of computer literacy in the population at large.

It goes much deeper than "Hit any key to continue?" If programs work in a consistent, understandable way, it is easy to explain how to use them — for an example of how not to do it, read "The Unix Road to Power" in our March issue. A programmed computer is an immensely complicated machine; and there are very few guidelines about how it should work. After a century of trial and error, the manuals of most cars do not now explain how to drive them — they are about the cigarette lighter and how to empty the ashtrays.

The limitation on most general-purpose software is now not what can be done by the hardware, but what can be explained so that the user can remember it without going mad. The Americans often provide huge menus allowing for every contingency. Their magazines assess rival products by counting the number of "features" each offers and the weight of the manuals. In fact the best package is the one with the fewest ineradicable bugs and the shortest manual. The perfect manual simply says: "Switch on". It can be that concise because the program is so lucid that it needs no explanation.

There is no simple recipe for manual-less software but we could build on those few conventions that already have a foothold. For instance CP/M users will be accustomed to the convention that "*" will stand for an unknown word in a file-name, "?" will replace an unknown letter, so that "File?. *" will match to "File 1. BAS", "File Z. PRN" etc. Secondly, operators should have logical validity within the operation of the program. You might be doing something on the screen and use ↑B to jump back to the top, left-hand corner. If the cursor is already in the top, left-hand corner, ↑B should jump back into the stage before the screen appeared — which might be a menu, and ↑B again should go to the menu before that.

There are plenty of chores that the computer could do. For instance if, at a certain stage, the user is only allowed to type in numbers the machine might just as well refuse to accept anything that is not a number. Another convention might be that from time to time the user has a default entry to use or replace. The cursor might be positioned on the first character; hitting Return leaves the default in place and moves on to the next operation; hitting any other permitted key clears the field and starts a new entry.

Any conventions must be consistent within the program. Users must not find themselves in positions where the program appears to work differently and you also have to compete with conventions established by other software products. But once you have these conventions working you can cut down the manual size — and the amount the user has to remember — simply by explaining briefly what is happening and then moving on. If your software is well designed, a lot of interactions between different processes can be ignored since they will be understood, or at least accepted at their face value, when the user comes to them.

Electronic engineering is no problem. Mental engineering is a whole, new untried field. Anyone got any ideas?

Our Feedback columns offer readers the opportunity of bringing their computing experience and problems to the attention of others, as well as to seek our advice or to make suggestions, which we are always happy to receive. Make sure you use Feedback—it is your chance to keep in touch.

Sorcerer graphics

FEBRUARY'S Z80 Zodiac contained a short article of mine about Sorcerer graphics. Unfortunately, four lines were incorrect.

In listing 1 line 1030 should read

```
1030 : AD= 1024 + (Y/8 - INT (Y/8)) *8 + 8 * (CH - 1)
```

Line 1040 should read

```
1040 : POKE AD. (2 ** (7 - 8*(X/8 - INT(X/8))) + PEEK(AD))
```

In listing 2, line 10010 should read

```
10010 POKE 260,0: POKE 261,48: REM IF ROUTINE STARTS AT 3000 H
```

In listing 3, line 40 should read

```
40 : DX = X2 - X1 : DY = Y2 - Y1 : IF ABS (DX) < ABS(DY) THEN 80
```

**Hans Middelbeek,
Goirle,
Netherlands.**

Petpro

A GREMLIN seems to have crept into my Petpro listing, *Practical Computing* December 1981. In line 119, ORI = C should be deleted.

**Ian Birnbaum,
Needingworth,
Cambridgeshire.**

Networked Pets

THE SIXTH FORM A-level group of our school is currently working on a network system for Pet 4032 micros. At present we have successfully programmed in Basic and implemented a system to allow keyboard conversation between two Pets using a connector constructed by ourselves for use with the parallel user port.

Anyone wanting further information such as how to construct the connector, and a documentation of our two-way Pet-Talker should write to us. Also, it would be appreciated if anyone who has produced a similar system would write to us with their ideas.

**J Cantrill, N Dutton, S Hancock,
N Hudson, A Lakin, N West,
The Pingle School,
Burton-on-Trent,
Staffordshire.**

Slide projection

THE BCD-DECIMAL decoder described in Philip Barker's February article on slide-projector control is the SN74145 not 7145. It has open-collector outputs, capable of sinking 80mA, and dual-in-line relays are available such as RS-349-383 which require only 10mA coil current. These may be driven directly from the SN74145, without the 7404 inverters and 2N3053 transistors shown in figure 4 of the article. Further, RS Components does not stock a relay with the code number given in the article, but the pin-out diagram corresponds to that of the RS-349-383.

**A W Joines,
Cambridge.**

Arfon speech board

THE REVIEW of the Arfon Microelectronics speech-synthesis board stated that a further £140 was needed to interface it to Pet, Tandy and RS-232. This is not so; a complete operational boxed system for the Tandy, Video Genie and RS-232 costs £138, for the Pet and Vic-20, £114, and the basic board for Nasbus 3/80 bus and Apple costs £98. These prices are for complete operational systems.

**P M English,
Arfon Microelectronics,
Caernarfon,
Gwynedd.**

In praise of Prestel

THE FATE of Prestel in this country must lie in the volume of sales during the next couple of years. Those of us who wish to see Prestel as a success, and not least British Telecom, must find a way to attract new subscribers. I have heard from many micro owners their envy at the great systems in the United States such as Source and MicroNet.

Such jealousy is misplaced — Prestel is just as effective a system. If you have a telephone, it will cost £15 for installation of the necessary Prestel jack socket. The quarterly rental is 50p. If your telephone line is not a business one, then you have no other rental cost for Prestel.

When you go on-line on the U.S. systems the cost for one hour during the cheap rate is about £2.50 plus the cost of the telephone call. The same time on Prestel at the cheap rate costs £1.20 including the telephone call charge and VAT. The only other cost that you may have is the page charge. Some of the information providers charge a small sum for the information they supply, but most Prestel pages are free.

Another thing Prestel has is telesoftware. This is an expanding field and we microcomputer owners can make the most of it. Look at your computer and think how Prestel will keep you in the forefront of viewdata.

**John A Douglas,
Dumbarton.**

Duncan in Comal

RAYMOND FOX'S challenge to produce a fully working Drunken Duncan program is a strange way to conduct a serious educational debate, but here is the program which was a source of my original article. There is no "rigmarole of subroutines". The program runs on an SPC/1 microcomputer and has been used for two years as a simple example of how a multiple decision may be handled.

Simple examples are used in articles to illuminate the essential ideas without bothering the reader with unimportant details, but if Mr Fox wants to see how medium and substantial jobs are tackled, there are 114 examples in my book *Structured Programming with Comal*.

Some versions of Comal use a three-line procedure for cursor control but the SPC/1 incorporates it in the system software. One can build up graphics packages using procedures, or these facilities can be built into the system software. But this is just the history of ideas moving from applications programs to systems software and finally into hardware. That is how computers get better.

It is quite wrong to say that Comal is full of complexities. Basic usually has a For loop, a local If-Then-Else and a primitive type of procedure, Gosub. It achieves multiple decisions with On constructions. Comal has the same For loop and tidies up the other three with a global If-Then-Else, named procedures and the Case statement. Additionally Repeat-Until, While-Endwhile cater for exit from a loop on a condition rather than a count. Why should Basic have For but not Repeat?

Advocates of Comal do understand the

(continued on page 45)

Duncan in Comal.

```
PRINT "Drunken Duncan"
across:=40;down:=12;stop:=0
REPEAT
  CURSOR across, down
  PRINT "*"
  dir:=RND(1,4)
  CASE dir OF
  WHEN 1
      down:=down-1
  WHEN 2
      across:=across+1
  WHEN 3
      down:=down+1
  WHEN 4
      across:=across-1
  ENDCASE
      step:=step+1
UNTIL across <20 OR across>
60 OR down <1 OR down> 23
PRINT "Duncan took"; step: "steps"
```

Drunken Duncan in Forth.

```
SCR # 47
( DRUNKEN DUNCAN DEMO *)  56 LOAD  ( RNDM NUMBER GEN )         <
0 VARIABLE XLEN   0 VARIABLE YLEN    0 VARIABLE STAGGERS        <
: LT 0 DO 4 EMIT LOOP ;  : RT 0 DO 9 EMIT LOOP ;                <
: UP 1 EMIT ;  : DOWN 2 EMIT ;  : LEFT 4 LT ;  : RIGHT 4 RT ;   <
: HOMEUP 16 EMIT ;     : CLEAR HOMEUP 22 EMIT ;                 <
: WHICH 3 CHOOSE 1- DUP ;     : SLEEP 2000 0 DO LOOP ;          <
: STAGGER WHICH XLEN +! DUP -1 = IF UP DROP ELSE                <
             IF DOWN THEN THEN                                  <
          WHICH YLEN +! DUP -1 = IF LEFT DROP ELSE              <
          IF RIGHT THEN THEN   1 STAGGERS +! ;                  <
: OFFGRID XLEN @ 0< XLEN @ 16 > OR                              <
          YLEN @ 0< YLEN @ 16 > OR   OR ; ( leaves boolean)     <
: INIT CLEAR 8 XLEN ! 8 YLEN ! 0 STAGGERS !                     <
      8 0 DO CR LOOP 32 SPACES ; ( CLEAR SCREEN CURSOR MIDDLE ) <
: DUNCAN INIT BEGIN SLEEP STAGGER OFFGRID UNTIL CLEAR           <
 ." OFF GRID IN " STAGGERS ? ." STAGGERS" ;      ;S FD  29 1 82 <

SCR # 56
( RANDOM NUMBER GENERATOR                              *)       <
0 VARIABLE RND     HERE RND !                                   <
: RANDOM RND @ 31421 * 6927 + DUP RND ! ;                       <
: CHOOSE ( u1 -- u2 ) RANDOM U* SWAP DROP ;  ;S                 <
( ie 3 CHOOSE returns a number between 0 and 2               *)<
                                                                <
                                                                <
                                                                <
                                                                <
                                                                <
                                                                <
                                                                <
                                                                <
                                                                <
                                                                <
                                                   ;S FD  31/01/82<
```

Drunken Duncan in Pascal.

```
PROGRAM DUNCAN ;
CONST
  (* CURSOR CONTROL CHARACTERS  *)
  LEFT = CHR(4); RIGHT = CHR(9); UP = CHR(1); DOWN = CHR(2);
  HOMEUP = CHR(16); CLEAR = CHR(22);
  TIME = 200 ; (* DELAY CONSTANT *)
VAR
  J,I,XLEN,YLEN,STAGGERS,COUNT : INTEGER;
  ANSWER : CHAR ;
  SEED : REAL ;

FUNCTION RND : INTEGER ;
CONST
  MULT = 149;
  DENOM = 10007 ;
VAR
  TIMES : REAL ;
BEGIN
  SEED:=SEED*MULT;
  IF SEED > DENOM THEN
  BEGIN
    TIMES:= TRUNC(SEED / DENOM) ;
    SEED:= SEED - TIMES * DENOM
  END;
  RND:=(TRUNC(SEED) MOD 3)
END;  (* RETURNS NUMBER FROM 0 TO 2 *)

PROCEDURE SLEEP ;
BEGIN
  COUNT:=0;
  FOR I:=1 TO TIME DO COUNT:=COUNT + 1
END;

PROCEDURE STAGGER ;
BEGIN
  I:=RND;
  CASE I OF
    0 : WRITE(UP);
    1 : BEGIN END;
    2 : WRITE(DOWN)
   END;  (* ENDS CASE *)
  XLEN:=XLEN+I-1;
  I:=RND;
  CASE I OF
    0 : BEGIN FOR J:=1 TO 4 DO WRITE(LEFT) END;
    1 : BEGIN END;
    2 : BEGIN FOR J:= 1 TO 4 DO WRITE(RIGHT) END
   END; (* ENDS CASE *)
  YLEN:=YLEN+I-1;
  STAGGERS:=STAGGERS+1
END;

FUNCTION OFFGRID : BOOLEAN ;
BEGIN
  OFFGRID:=((XLEN<0) OR (XLEN>16)) OR ((YLEN<0) OR (YLEN>16)).
END;
BEGIN  (* MAIN PROGRAM BEGINS HERE  *)
  SEED:=4999;
  REPEAT
    WRITE(HOMEUP,CLEAR); XLEN:=8; YLEN:=8; STAGGERS:=0;
    FOR I:=1 TO 8 DO WRITE(DOWN);
    FOR I:= 1 TO 32 DO WRITE(RIGHT);  (* CURSOR NOW AT CENTRE SCREEN *)
    REPEAT
     SLEEP;
     STAGGER
    UNTIL OFFGRID ;
    WRITE(HOMEUP,CLEAR);
    WRITELN('OFF GRID IN ',STAGGERS,' STAGGERS.');
    WRITELN;
    WRITELN('ANOTHER ONE? ');
    READ(ANSWER)
  UNTIL ANSWER<>'Y'
END.
```

(continued from page 43)

virtues of Basic. That is why we say keep the best of Basic but add the good structures, to get Comal — structured Basic. It is mainly the Goto statement we denigrate as the cause of much unnecessary confusion. It must be said that a sensible computing system should also have good direct-access files as some Basics and all Comal implementations have.

In Denmark, the only country where teachers are given equal access to both approaches, 95 percent now prefer Comal. They are not a "sophisticated elite". They work across the age-range seven to 19 and across the curriculum. Non-specialist teacher control of this remarkable new learning resource is a reality in Denmark in a way that we in U.K. are only struggling to achieve.

Roy Atherton,
Reading,
Berkshire.

Futile dispute?

I ENJOYED Raymond Fox's "Who needs Comal?" in the February issue of *Practical Computing*, but it seems to me that the entire argument is irrelevant. If neither side can agree that a particular feature of either language is a virtue then it is likely that the two languages are not serving the same purpose anyway.

Perhaps an analogy exists between computer languages and human ones. The French government's considerable efforts to keep the French language "pure" have failed. Esperanto has not yet made much impact on the world despite its logical basis. Good old English goes rambling on, inventing new words and changing the meanings of old ones with what one could once have described as gay abandon.

Human language evolves to meet the needs of the people who use it rather than the theories of academics, and people with different needs and requirements use different languages or different subsets of the same language. Surely computer languages will follow the same pattern, with the ones which are most widely available and which offer the user the greatest flexibility surviving regardless of expert opinion of their worth.

Ian Soutar,
Tunbridge Wells,
Kent.

Fast Forth

JUDGING BY THE "Who needs Comal?" article, Raymond Fox needs Comal, or any other language for that matter, to help open his mind. Languages are not rivals, they are communication tools. Why assume that a programmer uses only one language? Why does Mr Fox refer to other language users as "the elite"? Is it that he knows no other language himself?

I have several Basics. I also have Pascal, Common Pilot, Lisp, Forth, and two assemblers. I use the language best suited to the problem in hand. That often tends to be Forth, so I enclose a Forth listing of Drunken Duncan. Duncan starts in the middle of the screen and tries to get off it, the original Atherton illustration.

It took me 15 minutes to write and it ran so fast that I had to slow it down with the word Sleep to be able to see it. It allows a diagonal step as well as the vertical and horizontal. It is scaled so that the whole screen is used, but with an equal probability of Duncan making his exit from any of the four edges. As I use a CT-82 terminal, Duncan is written for cursor control rather than memory-mapped display. My Forth has no random-number generator so I had to write one, and the whole thing compiles into 543 bytes.

The program runs by typing the word Duncan. If you add the following:

```
0 VARIABLE SEED
: 4POSTERITY RND AT SEED ! ;
: REDO SEED AT RND ;
```

You can type 4 Posterity Duncan to see a performance, and rerun that same performance by typing Redo Duncan. Forth, is a structured, compiling, interpretive language all in one.

I have also included a Pascal alternative, which again has to be slowed down with a Sleep procedure. The p-code takes up 876 bytes, including Rnd and Sleep.

Frank Dale,
Shepperton,
Middlesex.

BDC-600 operates in the Unix tradition

THE BLEASDALE BDC-600 is the first British computer specifically designed for Unix-style operating systems. This machine should transform Bleasdale Computer Systems from a leading British company into a force in the international systems market.

The BDC-600 is a big micro capable of performing any task traditionally associated with minicomputers. It has extensive software and hardware development facilities, multiuser capabilities. and can run with a wide range of eight- or 16-bit processors. Industry-standard Multibus modules are used but a wide range of industrial interface modules is available.

This top-line microcomputer is expensive but excellent value. Although the machine will be mainly sold under OEM labels, Bleasdale will also have a network of dealers. Its Leicestershire factory should be busy with production of 500 systems targeted for the end of the year.

The BDC-600 uses Microsoft's Xenix implementation of the Unix operating system. Unix is fast becoming the standard on 16-bit micros, for its flexibility and elegance as well as its high portability. Eddie Bleasdale, managing director of Bleasdale Computer Systems is firmly committed to Unix-based systems and hopes that his firm will become a leading centre of Unix know-how.

Eddie Bleasdale with the BDC-600.

Peter Hollands who has been appointed the Xenix co-ordinator at Bleasdale, explains that each Xenix system will come with a host of software including the C language and of course Basic. The text-processing software is fully comprehensive and a compiler writing system and spelling-checking program are included. Graphics and information-handling software are also available. Xenix's only problems so far have concerned licensing agreements.

The Z-8000 version of the computer is complete with 256K of user memory, eight input/output ports, 500K floppy-disc system and a 10Mbyte Winchester hard disc. The whole package together with the software costs less than £10,000.

The Z-8000 implementation will shortly be followed by a 68000 version. A Z-80 board with CP/M, and a 6809 board with flex are available as is an 8086 with CP/M-86. For details contact Bleasdale Computer Systems, Francis House, Francis Street, London SW1P 1DE. Telephone 01-828 6661.

Making light of airfreight

AIRMAN SIX is an airfreight management system for the Apple II computer. It was originally developed for the needs of an established air operator. The program can handle most airfreight tasks including the printing of waybills, daybooks, back-referencing files. consolidations, and a number of other functions.

Airman Six can be tailored to the requirements of the user and comes complete with all the hard- and software necessary and enough user support to start operating the system properly. The package has been developed by Type-Air, which is about to launch a similar sea shipping and quotations system. Type-Air is at Farnburn Avenue, Slough, Berkshire. Telephone Slough 39418.

If your Vic-20 needs 35K memory, 40-column display and a colour writer, B&B Computers' black box could be the solution. For £220 plus VAT this expansion unit includes a 32K RAM board and an additional power supply to cope with the new electronics. It comes with all connecting cables and a replacement expansion socket and is guaranteed for 12 months. The Beeline Vic Expansion unit is available from selected dealers and by mail order from Beelines, Freepost, Bolton, Lancashire, BL3 6YZ.

How to give Pet a change of character

ALPHA PLUS is a character generator for Commodore Pet microcomputers which inserts easily into the present character-generator ROM socket. A length of wire connects the main unit to the second cassette port on the computer's main board, and a switch which fits on the side of the Pet and the necessary software are also supplied.

The standard version of Alpha Plus contains four character sets. The first two mirror the standard Commodore character sets, with a British pound sign replacing the dollar. This facility alone justifies the Alpha Plus, especially for British businessmen. The Alpha Plus is not solely a reaction against the all-powerful dollar, since the third and fourth character sets can contain virtually any characters.

Character sets exist for German, Russian, Hebrew and Kana — the Japanese alphabet. In addition there are graphic founts for various uses including games, electronics, APL, and finance. Screen founts can be provided to match printer founts. This is a facility that is especially useful when a Commodore Pet is used in conjunction with a daisywheel printer which may have interchangeable founts.

The standard Alpha Plus has the Greek characters so beloved of scientists and mathematicians in the third character set, and a graphics set in the fourth slot. The software supplied allows various character founts to be mixed on one screen, and includes a demonstration of the many possibilities of the package — there is even a facility for user-designed characters. All versions of the Pet are catered for, and documentation is supplied for each style of computer.

Software running on a standard Pet without Alpha Plus will still run on a converted machine, and software written with Alpha Plus will run on an unconverted Pet, though without the special characters. Alpha Plus is available from Avon Computer Rentals, 8 Eastbury Close, Thornbury, Bristol BS12 1DF. Telephone (0454) 415460. Enquiries about customised founts are also welcomed.

Triumph-Adler has developed software to enable users of this Microwriter to transfer text to the Alphatronic microcomputer. The Microwriter is a hand-held word-processing device featuring electronic handwriting. Now text can be generated on site — even on a crowded commuter train — and then transferred to the Alphatronic at a later date simply by plugging the Microwriter into the computer's communication port. The transfer software is available on disc, as is a new version of the Lexicom word processor, updated for the Microwriter input. For further information on the Microwriter interface contact Triumph-Adler U.K., 27 Goswell Road, London EC1. Telephone 01-250 1717.

Education at all levels

EDUCATIONAL MICRO USERS both sides of the border will be interested in the latest issue of the *Scottish Educational Review*. Subtitled "Microelectronics in Education", it is edited by Jim Howe of Edinburgh University's Artificial Intelligence department, and includes articles covering applications of the micro in education from primary level to university. In addition to a number of general features there is a piece outlining computer-assisted learning in the Physics laboratory.

Microelectronics in Education costs £4, or £2 if you are a member of the Scottish Educational Research Association. You can order it from the Scottish Academic Press, 33 Montgomery Street, Edinburgh.

Accountants' competition

ACCOUNTANTS should blot those balance sheets and hurry down to their nearest Commodore/CSM dealer to enter a competition for which the prizes are £6,000 worth of computer goodies. Commodore (U.K.) and Birmingham-based Computer Services Midlands are running a competition with a prize package of a Commodore 8032 microcomputer, 8050 twin floppy-disc unit, daisywheel printer, CSM Auditman accounts production, and time records costing programs.

The competition closes on April 28, 1982 and prizes will be presented during May 1982. Further information from Peter Mart, Computer Services Midlands, Refuge Assurance House, Sutton New Road, Erdington, Birmingham, B23 6QX. Telephone 021-382 4171.

The CBM-8000 system.

Dutch transmit software to serve more micros

RADIO NETHERLANDS is to broadcast another series of software suitable for a wide range of micros. This time it will be using its own communications protocol, the Hobbyscope code, which it hopes will become an Esperanto for communication between microcomputers as well as improving the capture rate of programs broadcast on both AM and FM radio.

The software will be broadcast to Europe on April 22 at 0950 and 1350 GMT on 11,930, 9,895, 6,045 and 5,955kHz and at 2050 GMT on 21,685, 17,695, 17,605, 15,220 and 9,715kHz. Details of other times and wavelengths for North America, the Pacific and Africa can be obtained from Radio Netherlands.

Programs are transmitted on the normal wavelengths from Hilversum in Holland and relayed via transmitters in Madagascar and the Netherlands Antilles to give worldwide coverage. Experience of the first two broadcasts suggests that good results can be expected from a simple, direct, receiver-to-cassette connection if you are within range of the Hilversum station. Program capture tends to be less reliable if the signal has been relayed, because of differential reflection effects. Signals bounced off the ionosphere experience varying reflectivity for different frequencies, resulting in out-of-phase data capture. Most micros will hang up and refuse to read any more program data if this happens.

Radio Netherlands and the listeners to its *Media Network* computer hobbyist programme have developed a transmission protocol which alleviates this problem. They also claim other advantages for the protocol in regular micro-to-micro communication, including, where permitted, the ability to send programs on the phone without the need for a Modem.

The Hobbyscope code is first loaded into the computer and then used to compile the received program into usable form for the host micro. This makes it possible to use successfully a program cassette for one micro on another. So far the Hobbyscope code is available for the Apple, DAI, Sorcerer, Nascom, OSI Challenger, Philips 2000, Commodore Pet, TRS-80 Model I Levels 2 and 3, South-West Technical Products, Sharp MZ-80K, Texas TI-99 and Commodore Vic-20. The ZX-81 has insufficient memory.

Hobbyscope should also compact data for micros such as the TRS-80 with a transfer rate of less than 1,200 baud resulting in more storage per disc or cassette, and continuous program capture off-air or from a telephone line, even if some incorrect characters are captured because of atmospheric or line noise. At present the transfer rate of 1,200 baud is too fast to ensure reliable transfer from transmitter to receiver so the latest test transmissions will be at the slower speed of 300 baud.

A booklet containing listings of the Hobbyscope Basic code and a cassette with both the translation program and sample Basic programs, is available at the cost price of U.S.$8, from Jonathan Marks, PO Box 222, 1200 JG Hilversum, Netherlands.

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Word processing for the first-timer

THE 3007 SYSTEM word processor is styled like an electronic typewriter to provide first-timers with a low-cost word processor, according to its makers the Dictaphone Company.

It is available as a stand-alone unit with its own memory and processor, or as part of a shared-resource system. The 3007 has a keyboard — with QWERTY, numeric pad and function keys — thin window display and 40cps metal daisywheel printer all in one desk-top unit. Under the desk an electronic control package and single floppy-disc drive gives the machine 140 pages of text storage.

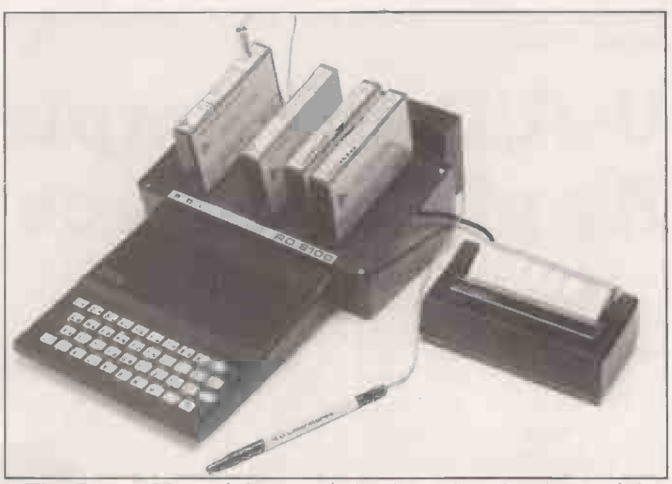
The 3007 has full editing, records processing and maths functions, automatic underline, centre and bold face. Text can be printed in 10 or 12 pitch with proportional spacing, and one task can be input while another is printed. As part of the Dual display system the 3007 can use a shared system rather than its own memory. The printer can be used by other operators while work is being keyed in. The 3007 stand-alone unit costs £4,700 and the shared-resource system costs a further £3,000. both available from Dictaphone, Regent Square House, The Parade, Leamington Spa, Warwickshire CV32 4NL. Telephone Leamington Spa (0926) 38311.

This is the CTM 300 Colour Terminal, which offers superior colour clarity and resolution to a 0.3mm. dot pitch. The terminal is serially RS-232 interfaced and is intelligent, with a standard display of 80 characters by 25 lines. It can also be programmed with other formats. The keyboard contains the usual QWERTY set together with function keys and a numeric keypad. Inside the keyboard unit lies the terminal's intelligence, a Z-80A processor. Standard features include a light-pen interface, a printer interface, American/European standards for power and video, a 256-character fount, and interface speeds of up to 19.2Kbaud. The terminal also has an automatic self-test routine and a CRT saver feature which extends the life of the display. The Terminal costs £1,107 and is available from Perdix Display Systems Ltd, 98 Crofton Park Road, London SE4. 01-690 1914.

ZX users taste real world with RD range

SINCLAIR OWNERS wanting to experience the delights of computing in the real world will welcome the RD-8100 series. The range includes two motherboards and five interface modules. At £40 for a basic system unit with a Micro-Mum, anyone with a Sinclair micro can begin toying with the interface between the machine and the real world.

The five interfaces are the RD-8110 logic input/output interface, the RD-8130 analogue input interface, the RD-8140 analogue multiplexor/amplifier, RD-8150 analogue output port, and the RD-8180 light-pen module. These units all connect to the ZX-81 via the motherboard. Super-Mum is a fully-buffered motherboard/console accommodating up to eight modules, and costs £40. The Micro-Mum only takes two modules but costs just £15.



The RD-8100 modules can be operated directly from the ZX-81's Basic, mainly by use of Peek and Poke commands. This can be accelerated if machine code is used. The motherboard is memory mapped to the ZX-81 RAM, each module having an address. A manual gives connection details. Prices for the modules are: RD-8110 £27.50, RD-8130 £29.50, RD-8140 £34.49, RD-8150 £29.50, RD-8180 £34.49. The modules are available from RD Laboratories, 5 Kennedy Road, Dane End, Ware, Hertfordshire. Telephone Ware (0920) 84380.

Holding data for 100 years

A BRISTOL FIRM has announced a new rival for paper. The SGS M-120 is a nonvolatile RAM device that can retain data without a power supply for 100 years. The device has a 256 by four-bit configuration, and uses a special n-channel, silicon-gate, double-polysilicon, MOS technology. This allows the contents of the memory to be written, erased, and rewritten electrically with maximum reliability and data retention. The M-120's internal structure makes access times short enough for it to be used without Wait statements.

The access times of the three versions of the device are 450ns., 700ns. and 900ns. The 900ns. version is specially suited to single-chip micro-computers. All versions are TTL compatible and come in standard 18-pin DIL packages. For further details contact BA Electronics, Millrook Road, Yate, Bristol BS17 5NX. (0454) 315824.

HP 32-bit system may overtake its rivals

HEWLETT-PACKARD'S 32-bit system could leap-frog 16-bit microcomputers. Strictly speaking the 32-bit computer would come within the mini end of the computer market, but its price might well place such a machine in direct competition with the larger micro systems.

A custom-built 32-bit VLSI chip will be used in conjunction with five similar custom chips. Hewlett-Packard is cagey about what products might incorporate 32-bit technology, but expects the first of a new range of such products to appear later this year.

The chip set comprises memory controller, RAM, ROM, I/O processor, clock generator, and a 32-bit processor chip less than 0.25in. square which contains 450,000 transistors. Dana Seccombe, manager of the research lab attributes the necessity of the design to simple physics. The less distance a signal has to travel the quicker it reaches its destination, which leads to higher processing speeds. Increased density also means fewer chips, which cost significantly less and improve reliability.

The system has been designed from the ground up. There are no off-the-shelf chips involved; every one has been designed to complement the others. In turn they required a fast data bus. It has a transfer rate of 36Mbyte per second. Hewlett-Packard has also had to develop a special copper-core technology to provide dissipative cooling for the system.

Ferranti Computer Systems has developed a processing system which enables the user to input and process Chinese text using a keyboard and a visual display unit. So next time you feel like spending an evening typesetting the entire works of Chairman Mao or scripting a revolutionary ballet about the perfidious Gang of Four, you will have over 8,000 characters in a special dictionary that comes on disc.

Floppy disc, stiff mailer

ALTHOUGH AT FIRST SIGHT the Mailsafe floppy mailers might make you reach for the origami manual they are in practice remarkably simple to use. The 5.25in. and 8in. disc mailers are each capable of protecting up to four discs.

For more details about the Mailsafe contact Basic Business Supplies, 50 Edinburgh Drive, Ickenham, Uxbridge. Telephone Ruislip (0895) 676012.

Star of file transfer

FILESTAR IS a software package for transferring text files from one type of computer to another. Used with the wide range of compilers, assemblers, cross assemblers, text editors and so on that are available for CP/M systems, it is a very powerful software-development system. Alternatively it can enable CP/M systems to offload software from some of the larger computers.

The package itself is written in Pascal and is available from MicroSec, 49b Market Parade, Havant, Hampshire PO9 1PY. Telephone Portsmouth (0705) 450055.

New launch by Lifeboat

LIFEBOAT ASSOCIATES has launched a new business-graphics package for microcomputer users. The software publisher claims that Graftalk has simple commands but can still produce a variety of bar charts, vertical or horizontal, with legend and axis labels, and pie charts.

The Graftalk package costs £255 including operating manual, and comes with a joystick mode with light-pen support for graphic design. Support is also available for CRT, pen plotter, and printer. An optional digitiser is also available. Further details from Lifeboat Associates, PO Box 125, London WC2H 9LU. Telephone 01-836 9028/9.

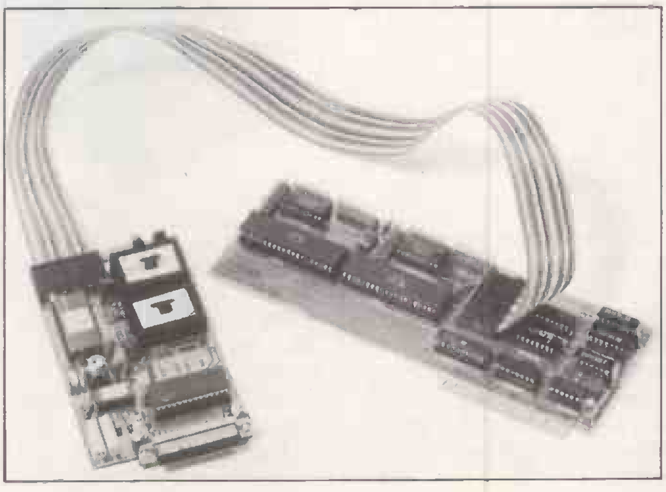
EPROM in kit form

THE MSC/A2 EPROM programmer can also be used as an EPROM memory board. This easy-to-build kit is suitable for most microcomputers, and directly fits the UK 101 or Superboard machines through a 40-way ribbon and plug arrangement.

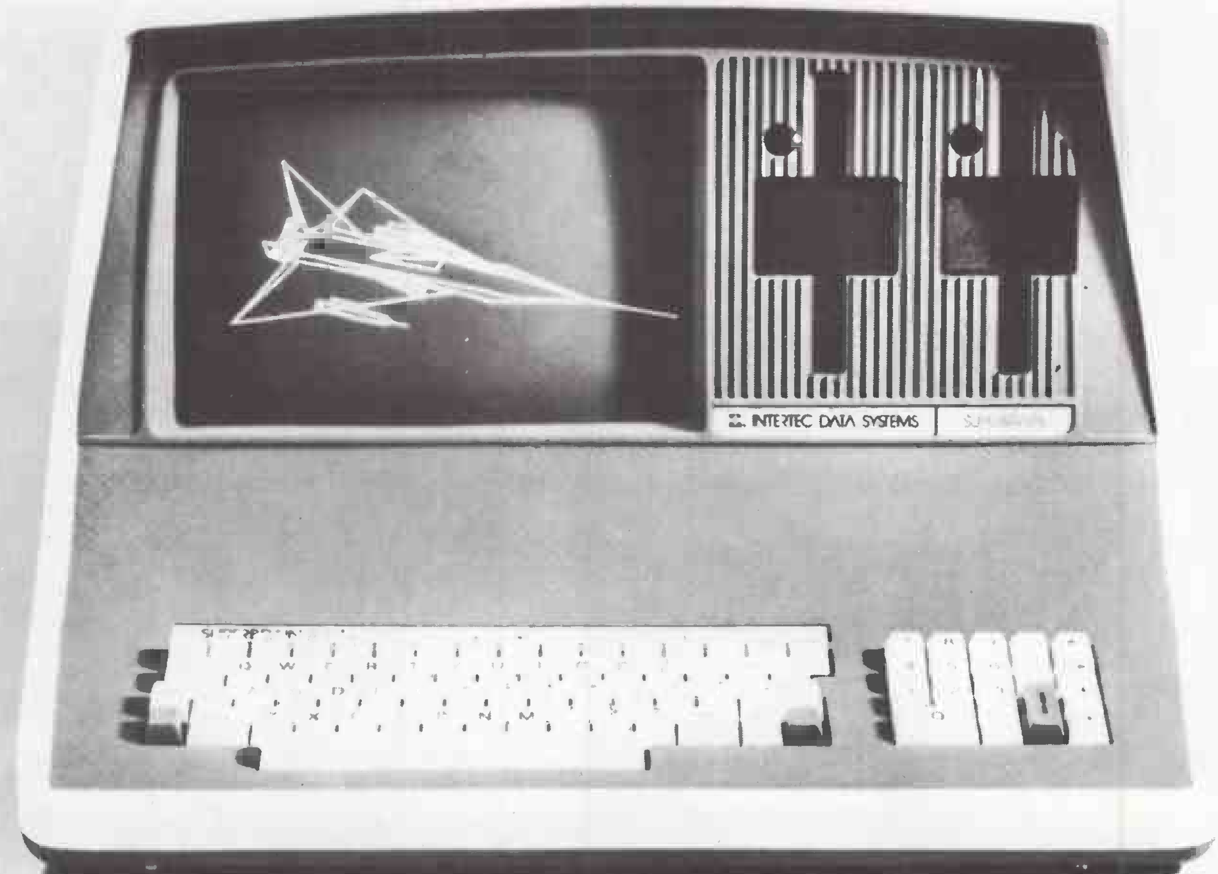
Prices are £59 to £95 for the basic kit, £4.95 for the 40-way cable, and £6.90 for the 24-pin ZIF socket. Kits are available from MCS Electronics, 9 Willowfields, Hilton, Derby. Telephone 0283 733802.

U-A/D is complete Apple interface pack

THE U-A/D complete interfacing system for the Apple II microcomputer includes an eight-channel, high-speed 12-bit A/D converter, 16 digital I/O lines and timer functions, complete documentation and example programs. Also available is the U-DT which, by including two 6522 VIA chips, provides 32 digital I/O lines and timer functions. For further details contact U-Microcomputers, Winstanly Industrial Estate, Long Lane, Warrington, Cheshire. Telephone Warrington (0925) 54117.



A business-like problem requires a business-like solution



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The Electronic Office. 32 West Street, Brighton, Sussex. Tel: 0273 722248/9
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Automate or die

Designed by ministers, written by civil servants, implemented by industrialists. Bill Bennett examines the U.K.'s policy for robots.

IN THE EYES of the British Government, a robot is "a reprogrammable mechanical manipulator". This definition does not stand up to deep semantic analysis, but for now it will do. In 1981 there were 371 of these devices in this country. At the beginning of this year there were 713. To coincide with the installation of the thousandth robot *Practical Computing* looks into the U.K.'s policy on robots.

The philosophy behind the Government's policy to introduce robots into industry is "modernise or die". At every opportunity the Prime Minister repeats the message. The trade-union movement also recognises the need to re-equip our manufacturing industry in order to compete in today's world economy. Mr Ken Graham, the Assistant General Secretary of the TUC believes that "the surest way for Britain to continue losing competitiveness and employment potential would be to pretend that we could turn our backs on technological advance".

Lagging behind

The robot population is steadily increasing as more industries find a use for them. Since Ingersoll's report for the Department of Industry revealed that Britain was being left behind in robot use and manufacturing, the DoI has promoted and given financial aid for automation.

It has made a robot film which has been widely shown to industrialists. Although not exactly *Star Wars* — industrial robots are not exactly C3PO for that matter — the film has been enthusiastically received. *Robots in Industry* runs for just over half an hour and is available on free loan or for purchase on film or video from the Central Film Library, Chalfont Grove, Buckinghamshire SL9 8TN.

Tangible support to industrialists comes in three different packages. The DoI believes that "feasibility studies are a very important exercise for investment appraisal". So it will provide half of the costs of an outside group to study the potential uses of robots in a particular company up to a maximum of 15 man-days of work. Companies must seek departmental approval if they choose consultants who are not yet on the approved list.

The Government is also injecting cash into the Science and Engineering Research Council. Here money is provided to pay for fundamental research into automation as well as investigating techniques and applications. Under this banner come the various joint projects which are run by both universities and industry. Paradoxically the universities which specialise in automation research are receiving massive cuts at the same time, and at the hands of the very same government.

Once a company decides to go ahead with a program of robotisation the Department of Industry can provide some financial support both for the initial capital outlay and the ongoing development costs. The Government attaches few strings to the cash. There is no upper limit to the overall size of a project but with certain exceptions a lower limit of £25,000 will apply. Any company can apply for a grant, and may keep reapplying as long as each successive application is different.

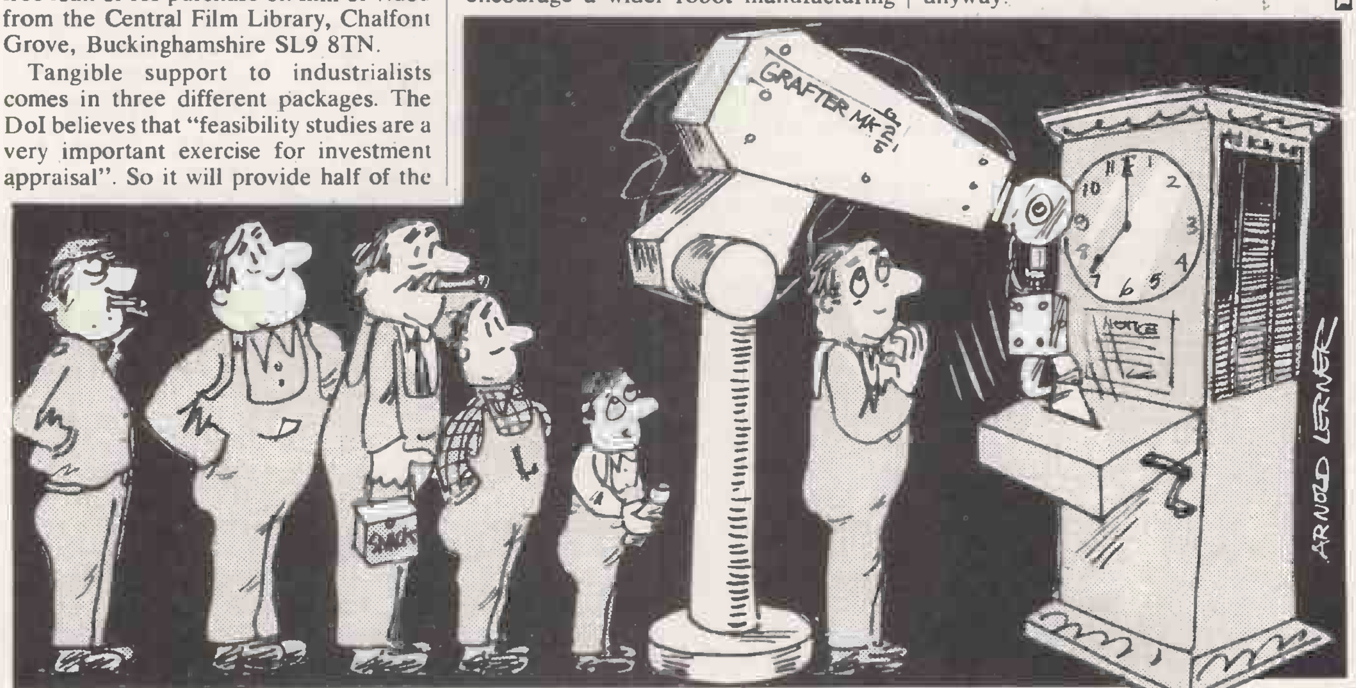
The Government is also trying to encourage a wider robot manufacturing base. Indigenous manufacturers are pretty thin on the ground at the moment, but this should be changing as new small engineering companies respond to the challenge of the robot.

Two robot manufacturers are already operating in Britain and a further two are importing and assembling Japanese robots under agreements. The manufacturers are Hall — which is part of GEC — and Unimation, which is based in Telford and is a U.K. subsidiary of an American concern. The companies which will be building robots under the guiding light of the Japanese are Dainichi-Sykes and the 600 Group which has an arrangement with Fanuc. Dainichi-Sykes is based in central Lancashire, the development area that includes Preston and Leyland. As well as manufacturing in the U.K. the company will be exporting to Europe a market which is expected to grow by around 2,500 units per year.

Insecure jobs

Concern that the increasing use of robots, especially in the industrial manufacturing sphere will lead to massive unemployment has been offset by fears that if Britain does not modernise, then her competitors will and even more people will be out of work. So far, not one British worker has been made redundant by a robot.

Those workers who have been moved to other tasks by their new, robotic colleagues, seem to be happy. Most of them are now engaged on far more rewarding work, both financially and mentally, and they realise that their old jobs probably would not have been secure for very long anyway.



MicroPro's PBM-1000 is not just another CP/M ... you WordStar, DataStar and SuperSort is fighting ... look at an eight-bit, 80K cream box that offers 30 percen...

PBM-1000

The PBM in action with Microline printer and TeleVideo terminal.

THE PBM-1000 is a sturdy, cream-coloured box that occupies an 18in. square of desk space, allowing for the protruding connectors at the rear. Because its internal electronics comprise a single horizontal board rather than the separate vertically-mounted boards of the standard S-100 arrangement, the cabinet is only 6in. high, and no more obtrusive than the average stereo unit. The front face features one double-sided 5. 25in. mini-floppy Tandon drive of around 800K capacity, and beside it the now familiar 5Mbyte Seagate mini-Winchester fixed-disc drive.

The drives each have a small LED, but on the review machine these did not follow the normal practice of lighting up only during disc activity. Curiously, one LED was always illuminated, corresponding to the last disc accessed. It needs a fine ear to hear whether a Seagate mini-Winchester is responding, and on occasions we missed the reassurance of the usual flickering red glow. To the right of the drives are the illuminated reset button and the on/off switch.

Access to the inner workings is a simple matter of unlatching the four attache-case clips that hold the top cover in position. This is certainly preferable to the kind of fiddly undoing some machines demand — 12 small bolts have to be removed to gain entry to the Rair, for example.

All that the interior offers is the sight of the single horizontally-mounted main board, and the only reason a user would want to get inside would be to set up the more-or-less permanent ribbon-cable connections to the terminal interfaces.

Support chips

The CPU is Zilog's Z-80A, operating at 4MHz without wait states. Support chips include Zilog's flexible, but costly input/output, PI/O and serial input/output, SI/O. We expected to find the Zilog direct memory access, DMA, chip completing the set, but instead a special two-chip module has been assembled on the front, left-hand side of the board to do more or less the same job.

DMA moves data around inside the machine without imposing the task on the CPU, and on the PBM-1000 the arrangement is claimed to leave 97 percent of the Z-80 chip available during floppy-disc transfer, and 70 percent available when accessing the Winchester drive. Certainly the disc access seemed noticeably faster than equivalent non-DMA hardware we have used in the past.

Field repair would typically consist of a straightforward replacement of the single board — something like 15 minutes' work to unhook the connecting cables and unscrew nine bolts. The simple physical construction gives little indication of the sophisticated logical architecture of the machine — the clue to that lies in the memory map — see figure 1.

PBM-1000 users need never know how the extension of internal memory is achieved, but the subject is worth a closer look. An eight-bit device like Zilog's Z-80 cannot directly address more than 64K. Bank-switching, the ability of a CPU to choose at any given moment which memory cells will be included within the 64K limit, is used by machines like the SuperBrain to make room for memory-consuming direct screen addressing without diminishing the internal space.

Because the technique is hardware-dependent, bank-switching is usually confined to the deep, inner workings of the system's software. Even then it suffers from the limitation that the banked-off sections of the program are isolated from each other, and a further level of program complexity has to be introduced if it becomes necessary to transfer data between sections.

CP/M traditionally resides in contiguous memory above the transient program area, TPA, the area occupied by application software and program data. While CP/M lords it from on high, its representative on earth, as it were, is a 100-byte block at the very bottom of memory — page 0 — through which the applications program is expected to pass calls to the operating system.

When the Bios disc-interface software is extended to drive a mini-Winchester system, CP/M can occupy as much as 12K. With the growing use of mini-Winchesters several manufacturers have been developing plans to shift the operating system on to a second bank.

The software that runs in the TPA makes frequent calls to the operating system, but only through two addresses in page 0. It might, then, seem simple to operate bank-switching code at byte 5 — the vector for most functions — and at byte 0, where a program will typically jump on termination to reinitialise the operating system and return to command level.

Unfortunately there are complications. Parameters have to be passed to the operating system and returned from it. Applications programs need some of these parameters to signpost file-control blocks and disc buffers in the area that is being swapped in and out; normally the existence of one bank remains unknown to the other.

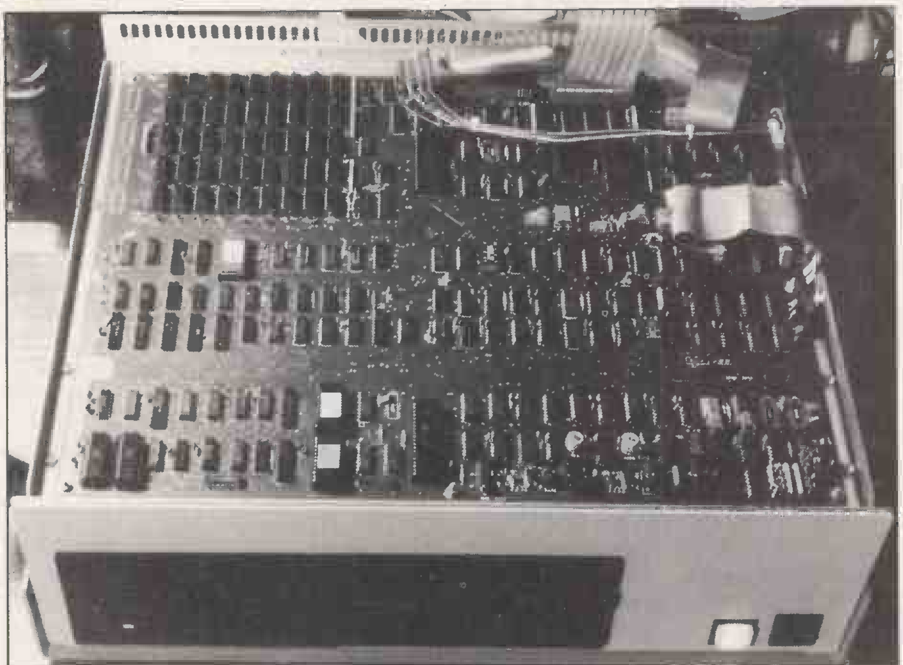
Top of memory

As the map shows, the PBM-1000 switches a pair of 16K banks at the top of memory. Most of CP/M resides on bank B, but it cannot set up data blocks there that need to be accessed by user software on bank A. Instead it creates mirror images on the user bank of the data blocks to be accessed.

A user program generating, say, a reference call to a disc parameter block is directed to a quickly-constructed facsimile of the real thing set up on bank A while the BShell software module handling the bank switching passes its address back from the banked-out operating system. The user program never sees the real thing; realistic data overlays are set up for it whenever it looks for them.

To set up a disc parameter block in a

computer: the Californian software firm who brought back against the 16-bit invasion. Chris Bidmead takes a extra user memory.


The computer's mainboard is easily accessible.

slim multi-purpose buffer while calculating its address and sending that back to the calling program implies a good deal of switching between the banks. The standard bank-switching arrangement streams data via a common area. Anywhere below C000H would do on the PBM-1000, but this is right in the middle of what is supposed to be the TPA.

MicroPro has cut through the inherent software hazards with an ingenious hardware fix. The Z-80 processor has a large repertoire of additional instructions compared with the 8080, some under-exploited and others best left well alone. Indirect port addressing is one of the more useful: the port whose number is held in register C will either be read to or written from by the instruction

```
IN r, (c)
OUT (c), r
```

where r is any register and represents the value in register.

If this were the whole story of the Zilog instruction there would be no PBM-1000. What happens inside the Z-80 as a result of this instruction is that the chip reads the entire double register BC and puts that word-length value on to the 16 address lines. This is the lightly-documented "extended indirect addressing" offered by the Z-80. In other words, the chip behaves as if obeying instructions of the form In r, (BC) and Out (BC), r.

Ordinary hardware implementations try to make Zilog's indirect addressing as similar as possible to 8080 direct addressing by quietly ignoring the higher address lines. The PBM bus lives life to the full by carrying the whole word-length address, and herein lies the secret of its bank-switching.

The bank which is switched in is seen by the processor as memory. It can access the switched-out bank as data by using extended indirect addressing to fetch and carry values as if from a 64K-sized array of contiguous ports. File-control blocks, disc parameters, and so forth can be pushed through the looking glass.

Unfortunately there is a price to be paid. The PBM-1000 architecture forces the Z-80 to see all ports as having 16-bit addresses. The ports of real-world devices like printers and terminals also have to be addressed indirectly, with the significant eight-bit value being sent out on the high address line and an indifferent value on the lower.

Data to the printer port, for example, will be sent to a port addressed as 91XX, where XX is an indifferent eight-bit value. Consequently the normal Intel compatible I/O instructions In and Out are not properly supported on the PBM-1000. Neither are Zilog's automated I/O mnemonics, which use a decrementing value in the B register.

Machine-independent

As a result the PBM-1000 cannot really be called a general-purpose computer. Most programs written to run under CP/M should sit happily in the PBM-1000 because they will avoid port-oriented instructions, using CP/M calls to keep the software machine-independent. But process-control applications, and software like Bstam — used for communicating between CP/M computers — that require the users to write their own port-oriented patches may prove to be troublesome.

The manual also warns against programs that trap calls within the operating system — these are not going to find the jump table in the expected place and will crash. A third category of potential non-runners would be programs that begin by going to addresses on page 0 to find out the size of the system. Software like this sometimes has range checking that may refuse to believe in the PBM-1000's 63K of user memory. Potential PBM-1000 users are advised to test any CP/M software before committing themselves to purchase.

Compatibility guaranteed

One big software house will of course be guaranteeing compatibility, and that's MicroPro itself. The review machine arrived with a raft of MicroPro software: WordStar and its satellites MailMerge and SpellStar, as well as the general-purpose database and form-generation program DataStar. We are also grateful to Terodec for a chance to look at Milestone, a useful critical-path analysis program from a non-MicroPro source.

WordStar must be the world's best-known word-processing program. It now offers horizontal as well as vertical scrolling, so that documents of virtually any width can be viewed on the screen while formatted as they will appear when printed. Previous versions made it possible to move, copy or delete blocks of text; enhancements to revision three include the facility to do all this to individual columns of text, which is useful in the creation of tables and "pasting up" newspaper-style pages.

The dynamic page-break feature, which shows you on screen exactly where pagination is going to divide your text on printout, is very valuable. The fact that WordStar is disc- rather than memory-based has always made it theoretically possible to work with text files running into tens of thousands of words, but on normal hardware this involves intolerable disc-waits, to say nothing of the danger of crashing out with disc-full errors. On a machine like the PBM-1000 large files become practical.

The large capacity of the hard disc makes a long-standing disadvantage of WordStar more troublesome: the instruction to display the directory shows every file, not just those whose extension denotes them as text files. Setting non-text files to system files with the Stat transient command will hide them from the CP/M Dir instruction, but WordStar's directory display refuses to acknowledge the Sys flag. At least WordStar III now respects CP/M's separate user levels, and no longer garbles directories on levels other than 0.

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With the addition of MailMerge and SpellStar, WordStar becomes a very comprehensive text-management package. SpellStar is yet another orthography checker, while MailMerge, generates junk mail from a mailing list, and supplies extra facilities like multiple printing a single block of text, linking files while printing. The combination is almost too top heavy for the average mini-floppy system, but the PBM-1000 hard disc is able to take the strain, with plenty of speed to handle the overlays.

The disadvantages are that the WordStar manual is monumental, you are stuck with American spellings if you rely on SpellStar, and MailMerge becomes complicated as you explore beyond its elementary capabilities. For many business users it may be best installed by a systems house.

Screen-based forms

DataStar is a neat way of creating the address files accessed by MailMerge. It enables the user to design screen-based forms that set out fields to be filled in by keyboard entry. Extensive error checking can be built in, ensuring, say, that numbers are not put in where only letters are expected, as well as checking ranges and doing elementary arithmetic where required. DataStar can also be set up to expand automatically short entries to full length, such as "ABC" to "Aerated Bread Company", by matching them against a table in a separate file.

The indexed sequential file that DataStar builds from these entries is essentially a chunk of ordinary text running in combination with one or more small look-up files that provide a crib to preselected key-words in each record.

Common-sense way

One advantage over the fixed-length records of a more sophisticated database is that the DataStar text file stores the data in a common-sense way, using a separate line for each record and demarking the fields within each record with commas. This makes it very easy to get at the fields and records via quickly concocted Basic or Pascal routines.

Valuable data can be safely left permanently on a hard disc. It was a joy not to have to juggle floppies in and out of the computer but floppies are by no means dispensed with once they have been used for entering applications software into the machine in the first place.

Insurance against the loss of formatting on a hard disc is provided by a program called Backup Com, which compresses data into a dense, non-standard format so that the entire hard disc can be contained on six floppies.

When a floppy becomes full during the back-up process, even in the middle of a file transfer, the program interrupts and prompts for the next disc, identifying the discs sequentially so that split files can be rejoined when restored to the hard disc. Back-up offers the options of copying:

- All non-system, accessed files for user (name a number)
- All non-system, files for user (name a number)
- All system, files for user (name a number)
- All files for user (name a number)
- All accessed files for user (name a number)
- All files for all users

System files like Pip and Stat stay unchanged in an ordinary system, so it is useful to be able to skip them when backing up. Similarly the back-up program is able to make automatic copies of accessed files that have been revised since the last back-up while ignoring non-system files that remain unchanged.

From the documentation Backup seemed the simplest and most flexible solution we have seen to the difficult problem of backing up a high-capacity hard disc on to mini-floppies. Unfortunately, while trying to get the program to work as documented we ran into a variety of problems. The disc drive would hang mysteriously in the middle of transferring a file, or the recovery module would fail to find a file on the disc we had just transferred it to.

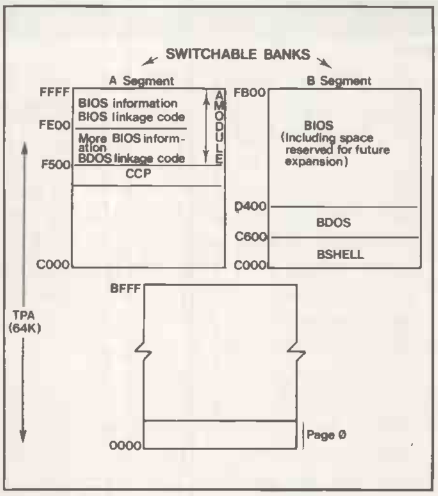

Figure 1.

The PBM-1000 has no built-in PROM monitor, which made diagnosis difficult. In the case of hardware faults there is provision for long-distance diagnosis from the service centre over a telephone line, but this would require extra hardware. The problem may have been in the operating system, because something like it recurred during speed checks on the hard disc, when it proved impossible to run our standard test of filling the disc with small files. CP/M returned a no-directory-space error message, although few directory entries had been written and Stat showed 3,196K of disc still theoretically available.

A second test to create a single, large file also failed. It was impossible to occupy more than about 2Mbyte of the 5Mbyte supposedly available on the disc. With exactly the same number of disc bytes remaining, CP/M returned a disc write error.

Among the hazards of reviewing are early versions of software and rudimentary documentation. We spent hours, for example, trying to get the RS-232 reader port to perform, only to discover that the pins on the printed circuit board confidently engraved "Modem" had been incorrectly marked, and should have been swapped with the pins labelled "Terminal".

Teething troubles

Apart from these teething troubles the PBM-1000 emerged as a fast, efficient and well-built computer for general business use. It is a pity that the techniques used by its designers to expand the capabilities of the Z-80 chip eliminate some of its more useful instructions, but it is a case of swings and roundabouts. The hard-won benefit of the extended core memory presents something of a paradox: none of the software we reviewed with the machine took advantage of it.

Large memory is currently needed in program-development applications, where the compilers of high-level languages like Pascal and C tend to create a squeeze in the traditional 64K; but the PBM-1000, monitorless and incapable of supporting the full Z-80 instruction set, is clearly not intended for intensive program development.

New 16-bit technology is rallying in the wings, promising friendlier software with comforts like proper error-trapping, fuller error message and the easing of syntax strictures. These are features that eat up memory, and Zilog's 64K address limitation affects the amount of upholstery a program designer can provide. The PBM-1000 spearheads the arrival of extended-memory machines from other manufacturers throughout 1982 as the eight-bit world prepares to fight back against the coming 16-bit invasion. The design of the PBM-1000 seems to imply that MicroPro has software enhancements up its sleeve that will make use of the big fast memory.

Conclusions

- **The PBM-1000 is a new design of Z-80-based microcomputer with a well-implemented hard-disc facility incorporating direct machine access.**
- **The novel architecture has some limitations, but these should not impinge on the ordinary business user.**
- **The machine is backed by a portfolio of well-established general-purpose software that the manufacturers have developed over the years.**
- **Although an American machine, plans are in hand for the PBM-1000 to be manufactured in the U.K. by the current importers Terodec, which should help to guarantee that good-quality national support is available.**

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● Circle No. 143

Genie I and II

Martin Eccles takes a look at two current microcomputers by the Hong Kong builders of the Video Genie.

YOU MUST have wondered about the Genie when it first came on to the market some two years ago. It was manufactured by Eaca, a little-known company, based on a small island off the coast of China famous for plastic mouldings not high-technology products. Its price and capability also seemed a bit too good to be true.

Nevertheless the Video Genie System, as it was then called, has taken off and recent new models, price reductions and additional hardware will make it even more popular. With the introduction of a "professional" system, the Genie II, the manufacturer intends to break into the small-business computer market. A Genie II with expansion giving a total of 48K RAM, two disc drives, a printer and a monitor costs around £1,700.

The Genie I differs from its predecessor in having a built-in sound generator, previously only available as an option, and an extra 1.5K ROM bringing the total to 13.5K. I was not impressed by the sound generator, but you may appreciate it if you like making up tunes or playing Star Wars.

The only drawback is the absence of a volume control. Each invader that goes down rewards you with a perforated eardrum. As the cassette recorder's switch can be used to turn off the sound, it is a pity that the playback level control could not have doubled as a volume control.

The extra 1.5K ROM, however, adds some really useful and readily accessible functions, namely

- Keyboard debounce,
- Flashing cursor,
- Automatic keyboard repeat,
- Machine-language monitor,
- Program renumber,
- Lower-case characters,
- Screen contents to printer command.

Keyboard bounce has been a problem with both the Genie and the TRS-80. It was solved in the original Genie by a piece of software on the demonstration cassette that had to be loaded into protected memory each time the system was switched on. Although it included flashing-cursor and keyboard-repeat routines, the new method is far simpler. One System command brings in all the functions, apart from the machine-

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language monitor which has a separate System command.

A flashing cursor is only of real value to an experienced programmer but keyboard repeat is useful to anyone, especially when editing Basic program lines. Nevertheless, specific editing commands dedicated to accessing part of a program line are still quicker, if you can remember them.

Commands

There are five commands in the machine-language monitor, each selectable by a single letter. They are,

- Display Memory,
- Modify Registers,
- Modify Memory,
- Start Execution,
- Return to Basic.

With these commands you can enter, modify, display and execute — with breakpoints — Z-80 machine code in hexadecimal format.

In display-memory mode, typing in the initial memory address displays 16 locations starting from that address on the screen. Pressing the down-arrow key displays the successive 16 locations, and up arrow the preceding 16. Up to 15 rows of 16 locations can be displayed at any one time — very useful for machine code. The commands Modify Registers and Modify Memory speak for themselves.

In Start Execution mode, you type in the starting address and the break-point address; break points are used for analysing and debugging programs. The monitor inserts Call 3347H at the breakpoint location and this instruction, when reached, causes all the registers to be saved and the original instruction at the breakpoint to be restored.

For those who frequently write Basic programs, the program Renumber function is a necessity. All Gotos, etc., are renumbered along with the program lines and the increment between each line can also be set. The whole operation is initiated by a letter and, if required, an increment value.

Character display

Lower-case characters with descenders below the line are fine provided that the picture quality of the TV or monitor used is good. You have to press the shift key to obtain them, which is disconcerting. I tried to get round the problem by fitting a small lever to invert the shift key's operation but shift/backspace deletes the whole line. This remedy seemed worse than the disease, so eventually I threw the lever away. With a little patience, the lever's function could be simulated by software which leaves the back-space key's function unaffected; for word processing this would be essential.

Shift; down-arrow; P is the command sequence to print out everything shown on the screen. If a printer is not connected to the system, the command is ignored. Without an expander the Genie can make a reset without losing the program. If you tell the computer to, say, LPrint with expander fitted but without a printer, you will eventually have to reset and the program can disappear. Screen Print is most helpful and can, for example, be used while a program is running to save a certain stage of a game, without affecting the program.

The Genie I is similar to later versions of its predecessor. The modified keyboard is used and the inbuilt cassette recorder has the playback-level control meter — which worked perfectly on both Genie is reviewed. Replacing one of the shift keys with two others has greatly improved the functions and ergonomics of the keyboard.

A Tab function is possible which, when shifted, gives increased character spacing. This key has a right-arrow on it and next to it is left-arrow, the old backspace function. The former backspace key now operates the Clear Screen function. The original Esc and Ctrl keys retain their original functions but now have up- and down-arrows on them, probably for games purposes.

After running for eight hours continu-

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Eaca's EG-602 printer appears to be identical with the Seikosha GP-80 and prints graphics, lower case without descenders and double-width characters.

The AVT monitor's screen is smaller than other 9in. units.

Genie specifications

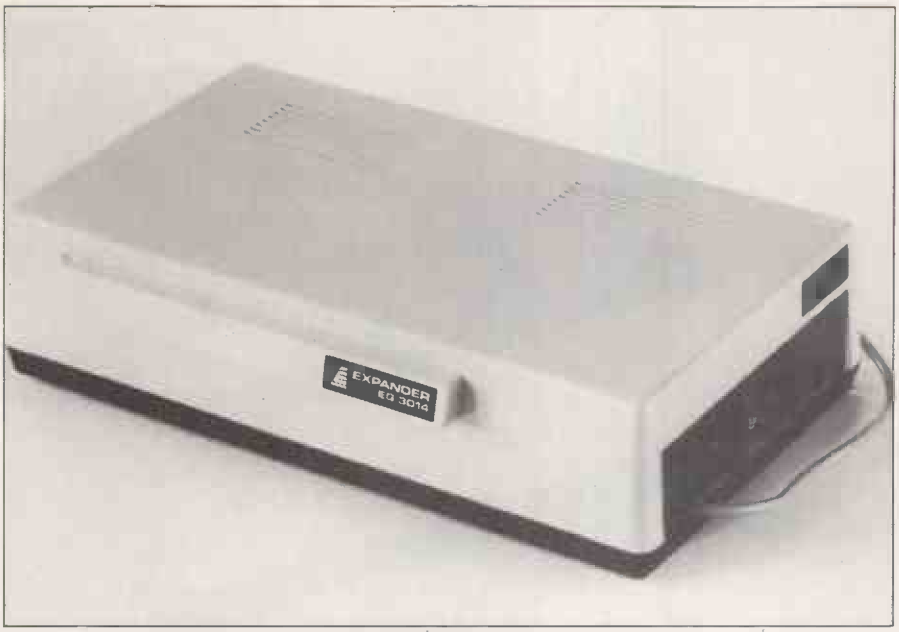
The two models, the Genie I home computer and the Genie II business computer, have the following features in common:

- Z-80 microprocessor
- 16K RAM
- 13·5K ROM
- TRS-80 software compatibility
- lower-case characters
- machine-code monitor
- keyboard repeat
- program renumber
- flashing cursor
- screen contents to printer command

The business computer has a numeric keypad in place of the cassette normally associated with the Genie, four special-function keys and an industry-standard processor. A software-controllable sound generator is standard in the Genie I.

The new "expander box" can be obtained with either 16K or 32K extra RAM and includes floppy-disc controller and printer interface. Up to four single-sided or two double-sided disc drives can be used and S-100 cards enable the memory capacity to be extended by forming banks. The RS-232 is an extra, but any printer with a Centronics interface may be connected to the expander.

The distributor also stocks a colour board giving six colours and 64 by 32 pixels, a telephone Modem, monitors, purchase and sales software and a "knock-down" desk for the system. Tridata Micros is to produce software for the Genie business system. In addition TRS.DOS, VTOS, Newdos, Newdos 80, CP/M, Fortran, Pascal, APL, Micro Cobol and Forth can all be run on a Genie disc system.



The expander box controls up to four disc drives and a printer.

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ously, the Genie I gobbled up the program and produced garbage on the screen. No amount of resetting would re-boot the system. Only after the computer was allowed to cool down totally did it work perfectly again. I know an old Genie with the same problem, but when the computer was taken back to the shop no amount of abuse — even wrapping it in blankets then subjecting its vulnerable parts to freezer spray — would make the fault reappear. Lowe, the Genie's U.K. distributor, assures me that this is not a common fault and a replacement machine worked perfectly.

Genie expander

I evaluated the Genie I with a new 32K expander, two disc drives, a printer, monitor and software, including Newdos-80. The system worked perfectly once set up and did everything that was asked of it. However, you need a 65cm. deep desk because the cable provided is too short to put the expander anywhere other than directly behind the computer. Other cables for the printer, disc drives and monitor are of ample length.

The DIN plugs for the monitor and second cassette recorder had their pins moulded in incorrectly and damage could have occurred if they had been forced into place. No polarity pin or notch is provided on the flat cables and they can all be inadvertently inserted the wrong way round, apart from the D connector on the printer.

Lowe now provides an attractive 9in. AVT monitor with the Genie. The screen does not dim as it fills with characters or bloom as brightness is increased — both problems with the OPC monitor Lowe used to supply.

Resolution and convergence are good but the line oscillator circuits occasionally produce an annoying whistle. This might be caused by a loose fitting somewhere in the review monitor, as the problem diminishes as the set warms up. Unfortunately the screen diagonal of the new monitor is an inch smaller than the OPC 9in. monitor. A block of 127 by 47 pixels on the OPC monitor measures 154 by 126mm. compared with 140 by 114mm. on the AVT monitor.

Printer problems

A logo on the front identified the printer supplied as an Eaca EG-602, but the manual sent was for the seemingly identical Seikosha GP-80. The EG-602 has been slow to appear in Lowe's price list but the GP-80 has been advertised for £195 plus VAT, which is good value. It prints lower case, without descenders, and graphics. It can accept 10 control codes for various printing modes, including double-width characters.

Each time I tried to print graphics, the screen width was printed in a column no more than 24mm. wide. The printer itself is probably not at fault, but you should find out how graphics can be expanded to cover the full paper width before you buy.

Disc-drive connections

The two EG-400 5.25in. floppy-disc units worked perfectly. Within minutes of being taken out of their boxes they were running Space Invaders from Molimerx, which took about eight seconds to load. These are 40-track drives according to most of the literature, though the specification sheet says they are 35-track drives. They are capable of storing 100K of formatted data, and access time is quoted as 20ms.

Up to four disc drives may be linked through a daisy-chain cable to the system. Alternatively two double-sided drives may be used; a double-density adapter is available for the new expander.

Each drive has a metal housing measuring 9 by 15 by 30cm. and although they are constructed as stand-alone units, no difficulty was found in positioning them. A one-metre cable links the expander and drive connectors on the two-drive daisychain cable.

The expander just sits there and co-ordinates with its on/off switch and a row of connectors. Its large size is acceptable considering that it can control up to four disc drives and a printer and has its own power supply. The expander can contain up to 32K of memory, and can be fitted with S-100 cards and an RS-232 interface.

Software provision

The Genie II computer is housed in the same case as previous models but the usual cassette recorder has been replaced by a numeric keypad and four programmable special-function keys. An industry-standard Z-80 processor is used. As there is no mention of increased clock speed, one can only assume that this has been done for reasons of reliability. A cassette recorder output is provided at the back of the computer.

The same expansion unit and peripherals are used for both Genie I and II. The II also benefits from the 13·5K ROM.

Dedicated software for the Genie II is being provided by Birmingham-based Tridata Micros. Titles include Stock Control, Payroll, Purchase Ledger, Sales Ledger and Nominal Ledger. Combined with the TRS-80 compatible interpreter and low prices of both the computer and peripherals they make the Genie II very attractive as a small business computer, not to mention its communications and networking possibilities.

According to Lowe, developments have been completed and will shortly be available to use the Genie II as an intelligent terminal for mainframe computers. Genie's manufacturer, Eaca, is clearly taking the business computer market seriously.

Conclusions

- **Considering that the number of Genie and related products stocked by Lowe has risen from one to 52 in just two years there is obviously a bright future ahead for the systems.**
- **On the home computer side, and perhaps even on the business side, Eaca will eventually have to come up with something better than their existing colour card.**
- **The Genie I has everything that similar systems have and usually at a lower cost.**
- **There are interfaces available for connecting Tandy peripherals to the Genie and vice-versa.**
- **The Genie I home computer costs £299 plus VAT; the Genie II professional model costs £310 plus VAT. They are distributed in the U.K. by Lowe Electronics, Matlock, Derbyshire.**

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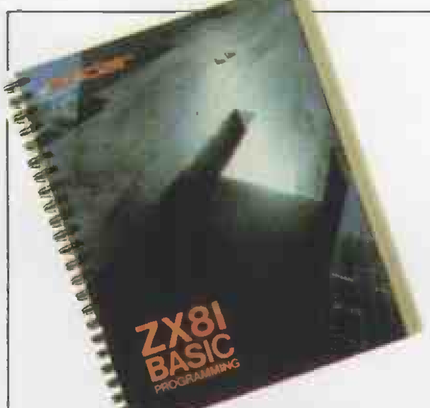

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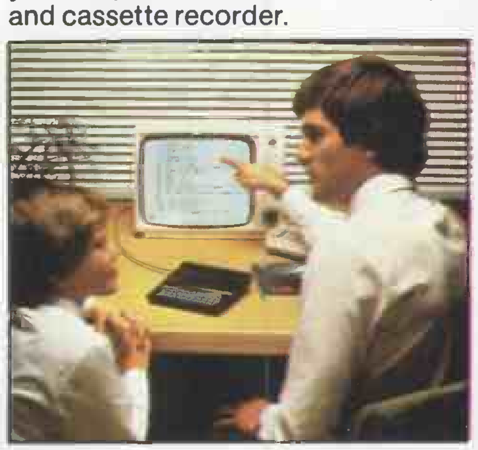

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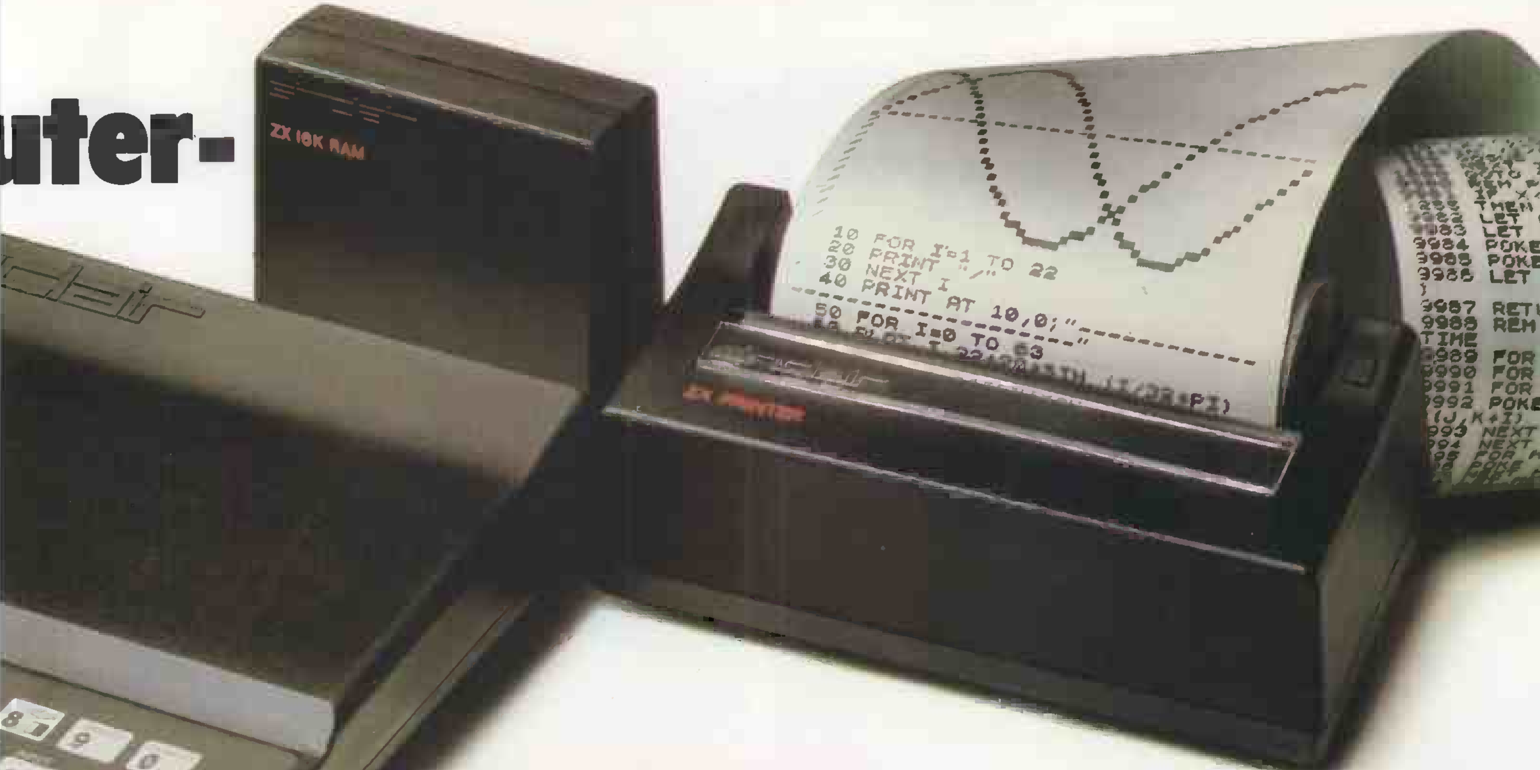

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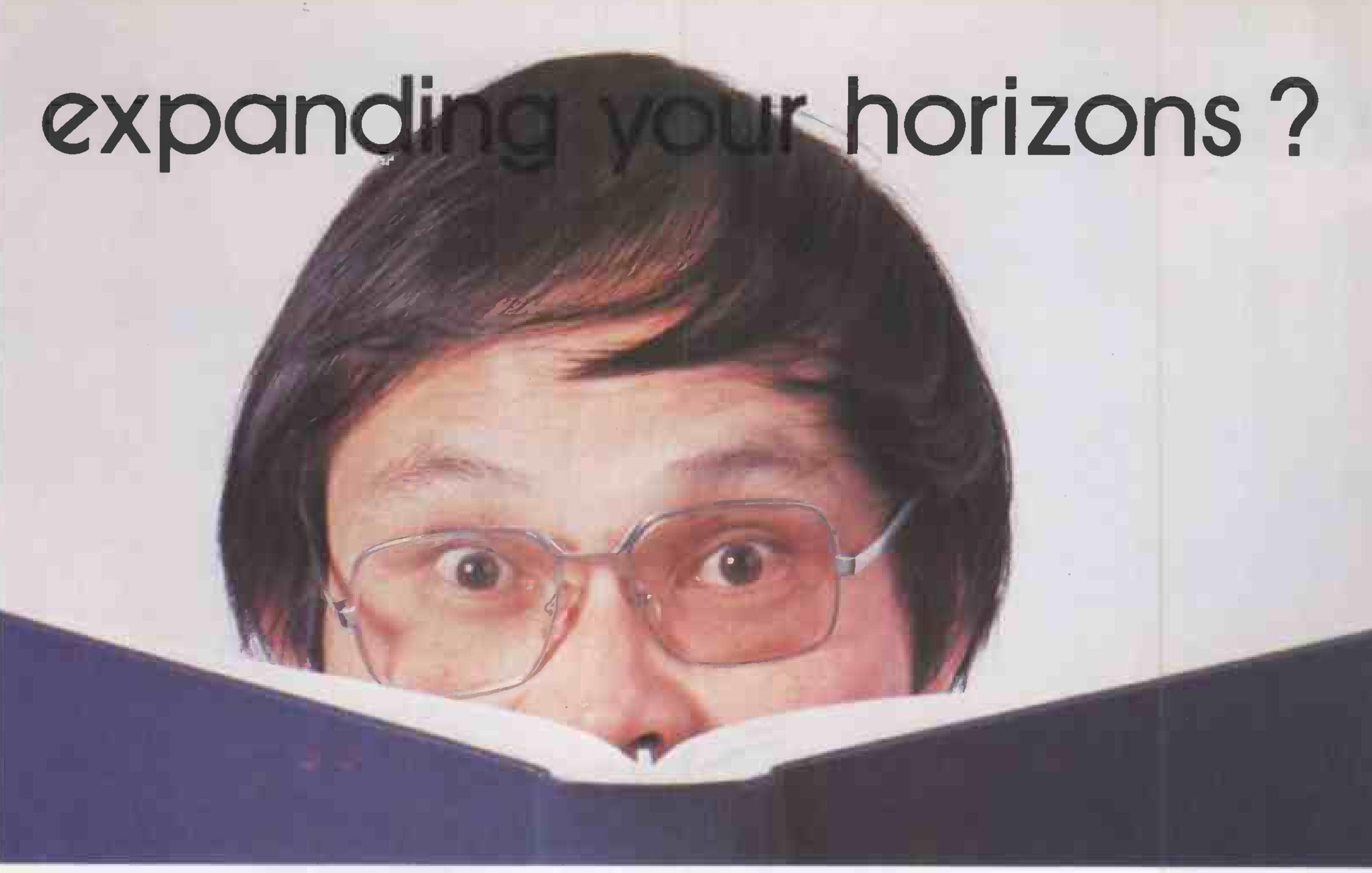

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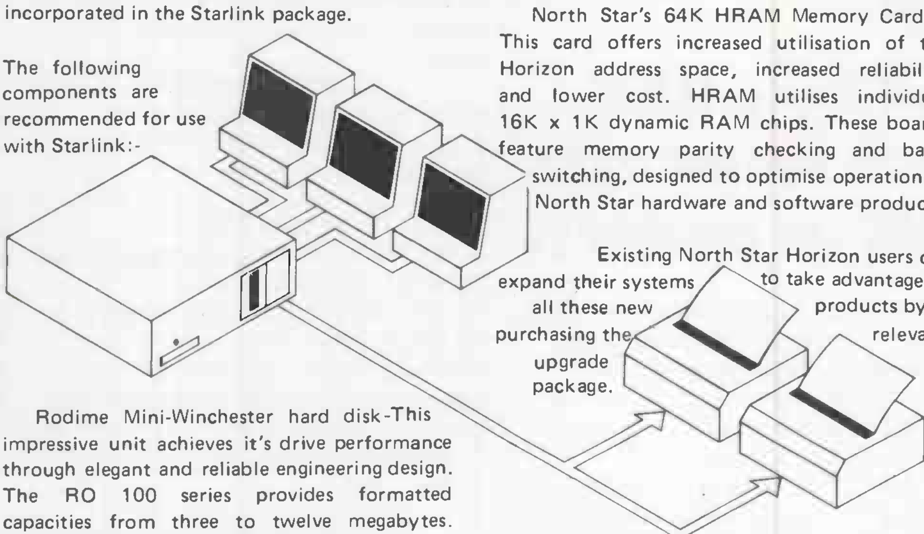

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Is Arfon's new light-pen an unnecessary gadget or an important tool for the serious micro enthusiast? Nick Laurie investigates.

ARFON LIGHT-PEN

OF THE TWO features of any light-pen which are vital in determining its quality, the first is the phototransistor. Its output is gated through a Schmitt trigger to clean up the wave-form to meet digital-computer standards. The second component is the push-button that tells the computer that the light-pen is at a point which is to be measured.

This measuring involves assessing the position on the cathode-ray tube of a lighted phosphor or, more often, group of phosphors. The time interval is measured between known cathode-ray tube control signals and the arrival of the raster scan at the point of interest. Software is used to calculate co-ordinate positions for this point.

Suitable hardware

The answer is to use the light-pen in conjunction with a cathode-ray tube controller chip which already provides a strobe pulse and timing functions. A typical example of this type of chip is the HD-46505S used together with a Z-80 CPU and plenty of memory in the Gemini Intelligent Video Card — reviewed in the March 1982 issue. It is not surprising, therefore, to find that this Gemini card already has a light-pen socket which matches this Arfon product perfectly.

Even those machines with video controllers not based on a single-chip design can usually be interfaced to a light-pen such as Arfon's. It took only two hours to have the pen working on a Nascom 2, and the Mimi 801 from British Micro also has a suitable socket for this pen.

The Arfon pen is of a sufficiently high standard to be used with the wide range of monitors, video controllers and general-purpose micros now in use.

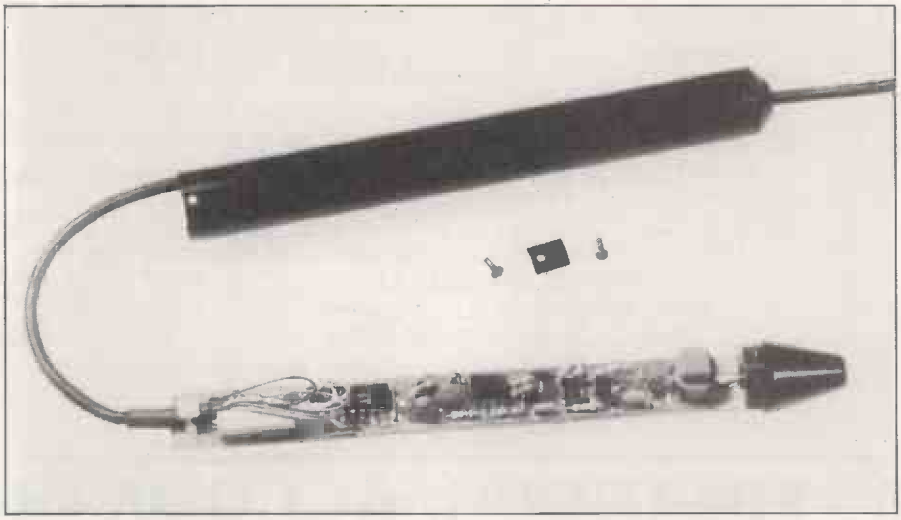
The photograph reveals the complexity of the circuit board inside this device. Double-sided glass fibre printed-circuit board has been used to carry the circuitry which debounces the push-switch and turns the strobe/phototransistor signals into suitably-gated square waves.

Some useful thought has obviously been devoted to the general design and layout: the phototransistor has been very neatly mounted in a separate "business end", the circuit board clips neatly into the body of the pen and the 4ft. of connecting cable is securely fastened to the assembly. The cable is terminated with a five-pin DIN plug directly matching the British Micro Mimi 801, the Gemini Galaxy 1 and the Gemini Intelligent Video Card.

We used a Gemini Multiboard system — a prototype of the new Galaxy 1 — with the light-pen plugged directly into the DIN socket on the Intelligent Video Card. This provides a way of reading the position of the light-pen directly as a pair of screen co-ordinates latched into the Video Card's registers.

Accuracy on an 80 by 25 screen. proved to be perfect when trying to detect a single block graphic point with the correct values being returned on most occasions. Errors were invariably caused by failing to hold this rather heavy pen perpendicular to the screen.

The Gemini Intelligent Video Card generates various screen formats and it seems likely that the light-pen could respond to far smaller areas than we used. The manufacturer claims that single pixels can be detected, but it is unlikely that the same repeatability could be maintained in this mode: background noise, bad aiming and a host of other features tend to obstruct very fine measurements.



Robust and reliable

All in all, though, the pen proved to be robust and reliable when used with a menu-selecting program designed specificially to test the pen. We would be happy to rely on such a well-built tool.

Unfortunately, we were provided only with a bare light-pen for the review: no interface, no documentation and no sample software. This makes it difficult to comment on the full package offered by Arfon which includes an interface, where required, and some software, all for £80 plus VAT and postage and packing.

In practice, it proved simple to interface to the Gemini, but the lack of documentation was more of a problem. Fortunately, it was possible to refer to the Gemini Intelligent Video Card manual for details of the software. It includes a routine for returning the current light-pen position, neatly packaged as screen co-ordinates. Using this and some unimaginative linking software, it was possible to show — in principle, at least — that this light-pen could track the display of a cathode-ray tube screen with repeatable accuracy.

Medium-resolution graphics consisting of a broad white line which followed the light-pen very closely around the screen was enough to show that everything was functioning correctly.

Adapting screen menus to give responses to a light-pen instead of a keyboard input proved to be entertaining and gave us a very reliable way of selecting information from the screen. If the light-pen becomes a standard feature in the next generation of micros, it will almost certainly lead to some general design changes in screen displays.

The software on the Gemini Intelligent Video Card made the light-pen simple to review. Interfacing to a Nascom 2 led to rather more erratic results although it did work after a fashion. Given the time or, possibly, the documentation and supplied software, it would not be difficult to interface this pen comfortably with most machines.

Conclusions

- **The Arfon light-pen is a robust tool at a very reasonable price — the pen alone is £35.**
- **If you are thinking of fitting a light-pen, this device will assure you of consistent, reliable inputs.**
- **As with most add-ons, software, is the stumbling block which can lead to the device being in the bottom drawer.**

Grown-up MBasic

Following the launch of Microsoft's extended MBasic compiler, Chris Bidmead provides an evaluation of the dialect. He finds that, far from being a beginner's language, MBasic incorporates a number of features aimed at the professional.

THE INTERACTIVE NATURE of Basic makes it much the most sympathetic language for the beginner, who benefits from an instant response to mistakes. However, the line-by-line execution required by interpreted Basic is ponderous compared with compiled languages, and programmed decisions and subroutines must be routed through line numbers and not, as is more usual elsewhere, by labels.

These are complications the professional programmer does not need, and would put Basic out of court for anyone but beginners, were it not for some rapid evolution since the language was first conceived in Dartmouth College by Professors Kemeny and Kurtz in the early 1960s.

The house of Microsoft, notably, has been quietly extending the language to cope with these problems. Microsoft's Basic 80, or MBasic as it is known in some versions, is a large interpreted language of around 28K, with powerful features and some rugged corners. The code written and debugged in the interpreter can be compiled using Microsoft's supplementary compiler and gives:

- Faster-running code, maybe 10 times in some cases.
- Protection for your source code.
- More compact, executable files.
- More room for machine-code subroutines.

When you load Basic 80 by typing "MBasic" from CP/M command level, the screen displays the version number, copyright data and the amount of free memory left. This number is often surprisingly small, only 27K, for example, on *Practical Computing*'s 64K Research Machines 380-Z. Any program that lists over 10 pages is pushing the limit of available memory, so it is just as well that interpreted MBasic, like the new compiler, has the facility to Chain from one program to the next, carrying data over in an area designated as Common for the development of large business packages.

Typing

```
MBasic <filename>
```

from CP/M loads Basic, then loads and runs the named program. This makes it possible to set up a CP/M Submit file, so that the inexperienced user need only boot the machine and type "Submit Accounts", or whatever the procedure is called. This can be made more friendly still by renaming the Submit file Run.com.

The CP/M command line can carry further instructions to define the number of files open at any one time, the upper limit of Basic's occupation of memory — to leave room for machine-code routines — and a redefinition if necessary of the default record size of 128 bytes. MBasic programs may be written in any editor that handles ASCII text, but the simple line-based editor provided inside the interpreter is adequate for most purposes.

To edit line 1060, for example, you type, naturally enough,

```
EDIT 1060
```

If 1060 is the last line entered, edited or listed it will still be in the buffer, and

```
EDIT.
```

is enough to evoke it. The editor lets you find the character, delete it, change it, insert characters, delete to the end of a line and list the line again. There are also more elaborate line-search facilities to jump to or delete up to the nth occurrence of a character.

Control-H (backspace) can be used on many machines to scan backwards in the same way that the space bar in edit mode scans forward character by character. Some Bios implementations trap this function and may also affect deletion in the editor. Unnecessarily, three different conventions handle deletion of characters.

When a line is entered, the Delete key steps the cursor to the left, erasing the last character by removing it from the screen. In the editor, pressing "D" deletes the character that follows to the right of the cursor with a Teletype deletion convention that prints <backslash> <character> <backslash>. When the editor is in insertion mode, the delete key advances the cursor one character at a time to the right, printing an underline for each press of the key.

All this is likely to be complicated further by your monitor's ideas of what the characters should be. *Practical Computing*'s 380-Z, for instance, thinks that <backslash> is best represented by "½".

Microsoft Basic is frequently thrown in by manufacturers to provide some semblance of animation to the raw hardware, but there is seldom any attempt to configure its console input/output to avoid idiosyncrasies of this kind. Deletion would be easier if the cursor moved backwards to overwrite the last character in all three modes.

There is a useful, if limited, Renumber facility. Renum by itself tidies up the whole program to start at line 10 and increment in 10s. The command may also be qualified with parameters, so that, for instance, Renum 10000, 300, 3 changes the numbering of line 300 to 10000, all subsequent lines being incremented by three. Lines that precede 300 are not affected.

Any renumbering facility has to make sure that line references within lines are properly reordered so that Gotos and Gosubs still hit their targets. MBasic is meticulous about this, but unfortunately Renum insists on renumbering from any given line number up to the final line of the source file, and cannot be limited to small sections within the sequence. If you want to reposition a subroutine that runs, say, from 15000, you have to put up with the whole of the program after line 15000 being renumbered as well.

The alternative is to Delete the entire program except for the target subroutine, renumber that, save it as an ASCII file on disc with

```
SAVE "<filename>,A"
```

reload the original program and Merge the renumbered subroutine back into the program. If you need to do this often you are probably writing very bad Basic programs, but even its occasional use is tiresome.

It would be more helpful if Renum could be confined to a subrange of numbers, although MBasic would probably have to carry a forbidding amount of extra code to implement this securely, checking Gosubs and avoiding duplicate or overlapping line numbers.

One other apparently cumbersome feature of MBasic is its file handling. Files are either sequential — serial input or output — or random. The serial modes let you write or read data from the disc as if it were winding through the system in a continuous strip, like a tape machine. You have to start each read or write from the beginning of the file, and you must define the file as either read or write — but not both — at the moment of opening.

The alternative, random files, allows reading or writing without these restrictions, and records can be accessed in any order as if the data were set out in an array of numbered pigeon-holes. However, MBasic's implementation takes three stages which distort Basic's original, transparent English-like coding.

First, the file is opened for random input/output with its record length optionally specified; the default is 128 bytes. The "shape" of the record then has to be set out with the Field instruction, which means defining to the system the size of each data segment within the overall length of the record. This is the purpose of line 20:

```
10 OPEN "R", #1, "FILE", 32
20 FIELD #1, 20 AS N$, 4 AS A$, 8 AS P$
```

(continued on page 73)

```
100 NDX% = 1                    initialise the array index
110 WHILE A(NDX%) <> 999
120 INPUT "NUMBER"; A(NDX%)
130 NDX% = NDX% + 1             next element of the array loop, or resume here on exit
140 WEND
```
Listing 1.

(continued from page 71)

```
30 INPUT "2-DIGIT CODE"; CODE%
40 INPUT "NAME"; X$
50 INPUT "AMOUNT"; AMT
60 INPUT "PHONE"; TEL$: PRINT
70 LSET N$ = X$
80 LSET A$ = MKS$(AMT)
90 LSET P$ = TEL$
100 PUT #1, CODE%
110 GOTO 30
```

Each field must be a string. Datatypes other than strings can only be assigned to the record after being converted to string format with the special function MKS$ — pronounced "make string" — as in line 80 of the example. The fields are then conveyed to the record buffer with LSet or RSet to position them left- or right-justified within the available space. They are then dispatched to disc with the Put instruction.

Retrieving information from the disc in random mode involves a similar process in reverse order. It is easy for the programmer to go wrong: for example, the size of the record as fielded must not exceed the size in the Open instruction, and if this in turn is greater than 128 bytes, MBasic has to be given prior notice on powering up.

Much of the unfriendliness is caused by the uneasy interface with CP/M, whose random-file facility arrived in version 2.0, rather as an afterthought, and then had to be adjusted again in version 2.2. In the version of MBasic called Standalone Disc Basic, which requires no operating system and copes with physical file handing on its own, the distinction between sequential and random files becomes unnecessary, enabling mid-file updating of files otherwise treated as sequential.

Within the limited data types allowed by the original concept of Basic, MBasic permits numerical constants and variables to be defined as integer, single or double precision, for which the system sets aside two, four or eight bytes respectively. This limits the integer range to between −32,768 and +32,767, or 0 to 65,535 in some versions. Single-precision numbers are stored with seven digits with a print limit of six, while double-precision numbers are printed and stored with 16 digits.

Arrays may have any dimensions up to 255, and provided the numerical value of any subscript does not exceed 10 the array may be assumed as needed, with no previous declaration. Larger dimensioned arrays have to be predeclared with the Dim statement. Arrays occupy the same space as the equivalent number of elements, with no overhead for the array structure.

Strings carry an overhead. The characters forming the string reside in a stack that grows downwards from the top of available memory, overwriting CP/M's command-line interpreter, which is not used in MBasic. Three additional bytes are needed for each string: one to define the length and two to act as a pointer to the start of the string in the stack.

Programmers can define data type as they go along by making the final character of each variable the symbols % for integer, ! for single precision, # for double precision or $ for string.

Alternatively you can make global data declarations of the form:

```
10 DEFSNG F
```

in an early non-executing line that defines all variables beginning with the letter F — or whatever character is chosen — as denoting single-precision numbers. Defint, Defdbl and Defstr do the same trick for integers, double-precision variables and strings. The default takes any named variable to be singleprecision.

Num and Num! are not redefinitions of the same variable — a single-precision variable restated as an integer — but if co-existent in a program will be known to MBasic as two entirely separate identifiers. Careless handling of variable definition can account for many intractable little bugs.

Despite the default to single precision, it pays to use integers wherever possible because execution speed and array sizes depend crucially on the specified precision. For example, a loop using an integer control variable can execute up to 30 times faster than one using double precision.

The Dartmouth College standard allows only one form of repetitive structure, the For-Next loop. It is known as a "deterministic" loop, because the number of times the loop will execute is predetermined by the program.

In the MBasic interpreter a While-Wend construction is also allowed, to implement non-deterministic loops. The While statement tests the data before each cycle and in the absence of a particular condition, supplied by the programmer as a parameter, the loop is skipped, and the program resumes at the matching Wend statement. This construction might be used in a section of code designed to accept a previously undetermined number of data entries from the keyboard — see listing 1.

Basic processing must follow the sequence of line numbers except where redirected by If-Then decision statements, Loop instructions or diversions via Gosub and Goto. Even so the program flow cannot escape from its numerical prison: all these redirections have to be made in terms of line numbers, and no calls by identifier reference are allowed. This accounts for the structural mires the language leads you into, and also clouds the "transparency" of the code.

Gosub 7000 does little to explain its purpose to the reader; in Cobol, on the other hand, the programmer may predefine a subroutine in a card-playing program — for example, by giving it the name "Shuffle" — and call that routine from appropriate places in the program with the instruction Perform Shuffle.

MBasic provides one exception to the line-number rule: the programmer is allowed to use early lines of code to define functions that may subsequently be called by name, with no line number references. For instance,

```
DEF FNX(Y$) = (Y$>= 'a') AND (Y$ <= 'z')
```

will test Y$ for the quality of being a lower-case letter, returning the value −1, which is MBasic's code for "True", if it is, and 0 if it is not. Functions defined like this cannot, as in CBasic, be extended beyond a single logical line, although there are ways of coping with the problem.

MBasic output to the screen or to the printer can be controlled with an extensive set of Print Using instructions. These are difficult to master but make formatting very easy. The MBasic manual takes four pages to explain the intricacies, and its laconic style still leaves much to the imagination.

One of our *Practical Computing* staff commented that he typically spends as much time debugging the Print Using statements as in making the rest of the code work. If you find this happening to you, watch out. The cosmetics of MBasic's powerful individual statements are diverting you from the real problem of turning your algorithm into code.

To a programmer brought up on the puritan virtues of Fortran, the string-handling facilities are succulent to the point of indecency. In addition to the usual Right$ and Left$ functions MBasic allows Mid$(X$,I,J), which returns the string J characters long, starting at the Ith character. Omitting J makes the function return everything to the right of the Ith character.

Most powerful of all, Mid$ is also available as a statement for in-house string alteration. Suppose:

```
L$ = "I love Susie"
```

Then the afterthought:

```
MID$(L$,7) = "Rosie"
```

gives L$ as

```
"I love Rosie"
```

The operators > and < can be applied to the ASCII set and, by extension, to strings. Logical string comparison matches off two strings character by character, subtracting the ASCII codes. If the strings are of different lengths but match as far as they go then the shorter is declared "smaller".

(continued on next page)

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The Swap statement, a general-purpose instruction to exchange the values of two variables, is particularly useful in combination with string comparisons, making alphabetic sorting very easy.

A professional feature of MBasic is the error-handling facility. If you put an early line in the program, for example,

```
10 ON ERROR GOTO 50000
```

you can then, from 50000 on test for and remedy all sorts of program errors.

For instance, left to itself MBasic will respond to a Disc Full error condition passed up from CP/M by posting the appropriate notice on the console and crashing out. This On Error command, in conjunction with a matching line in the 50000 error routine can divert program flow from the automatic error handling and offer you options that keep you in the program. It could start

```
5000 IF ERR = 61 THEN PRINT "No room left
  on the disc"
50005 rem 61 = "disc full"
500010 files "*.DAT" rem display existing data
  files
500020 INPUT "Which file would you like to
  delete?"; FILE$
```

You can even set up the routine to respond differently to the same error depending upon the line in which it occurred, with a statment of the form

```
IF ERL <10000 THEN PRINT "Do you want to
  start a new disc?"
```

Once the problem has been sorted out the program can be returned to the point where the error occurred with the statement "Resume".

To make your error handling really comprehensive you can include procedures to deal with errors that arise in your program rather than MBasic. Thus, supposing you expected only lower-case letters to be typed in, you could have

```
30 A$ = INPUT$(1)   rem this statement
  accepts a single key
40 IF NOT FNX(A$) THEN ERROR 100
```

FNX(A$) is the lower-case checking function we defined earlier. Error 100 is our own invention, as MBasic's system errors only come in 67 varieties, leaving numbers 68 onwards to be defined by the programmer.

Error trapping is no fun and takes up big chunks of code, but if you are writing programs for the commercial market it is essential to avoid dropping the user back into CP/M with nothing but an obscure systems error message to stare at. MBasic's error-handling capability gives it the edge as a professional programming language.

For the rest, MBasic is not so much a language as a substantial dictionary of commands, rich enough in its vocabulary to be patched together to do practically anything. But a true "language" ought to give you a tool for thinking about the problem as well as implementing the solution.

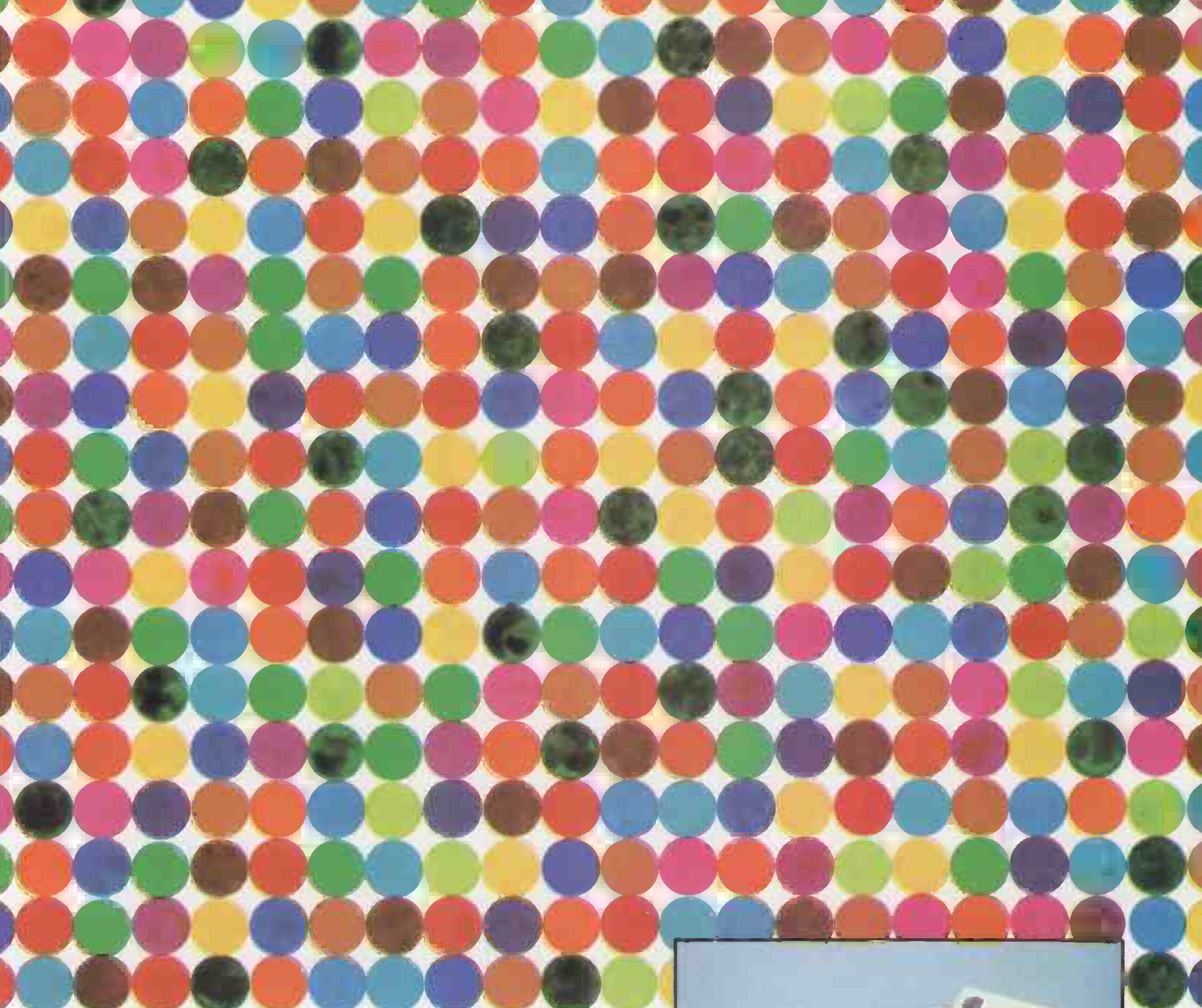
Well-structured, serviceable programs can be written in MBasic, though it does require the exercise of external discipline to hold together the structure of programs of any length. MBasic itself is an accretion of patches on the originally simple "get you started" idea. If you are not careful the programs you write in it will be in much the same mould.

It seems likely, for two reasons, that this process of accretion will continue: many people now regard the language as a standard for microcomputers; and the new generation of 16-bit machines will provide the space for expansion.

An almost identical version, called Basic 86, is already available for the 16-bit 8086 Intel chip. Later versions of MBasic are likely to feature

- named subroutines, with local variables,
- multiline user-definable functions,
- local renumbering,
- a more extensive editor, with global string search and replace.

Animosity to Basic runs high, particularly in academic circles. The Danish computer language expert Professor Edsger Dijkstra makes no bones about his views: "When it comes to teaching them programming", he says, "students who have had prior exposure to Basic . . . are mentally mutilated beyond hope of regeneration". Nevertheless, MBasic, with its wealth of facilities immediately to hand as you build your program, confers on the hardware a vitality that no other software seems yet able to offer.



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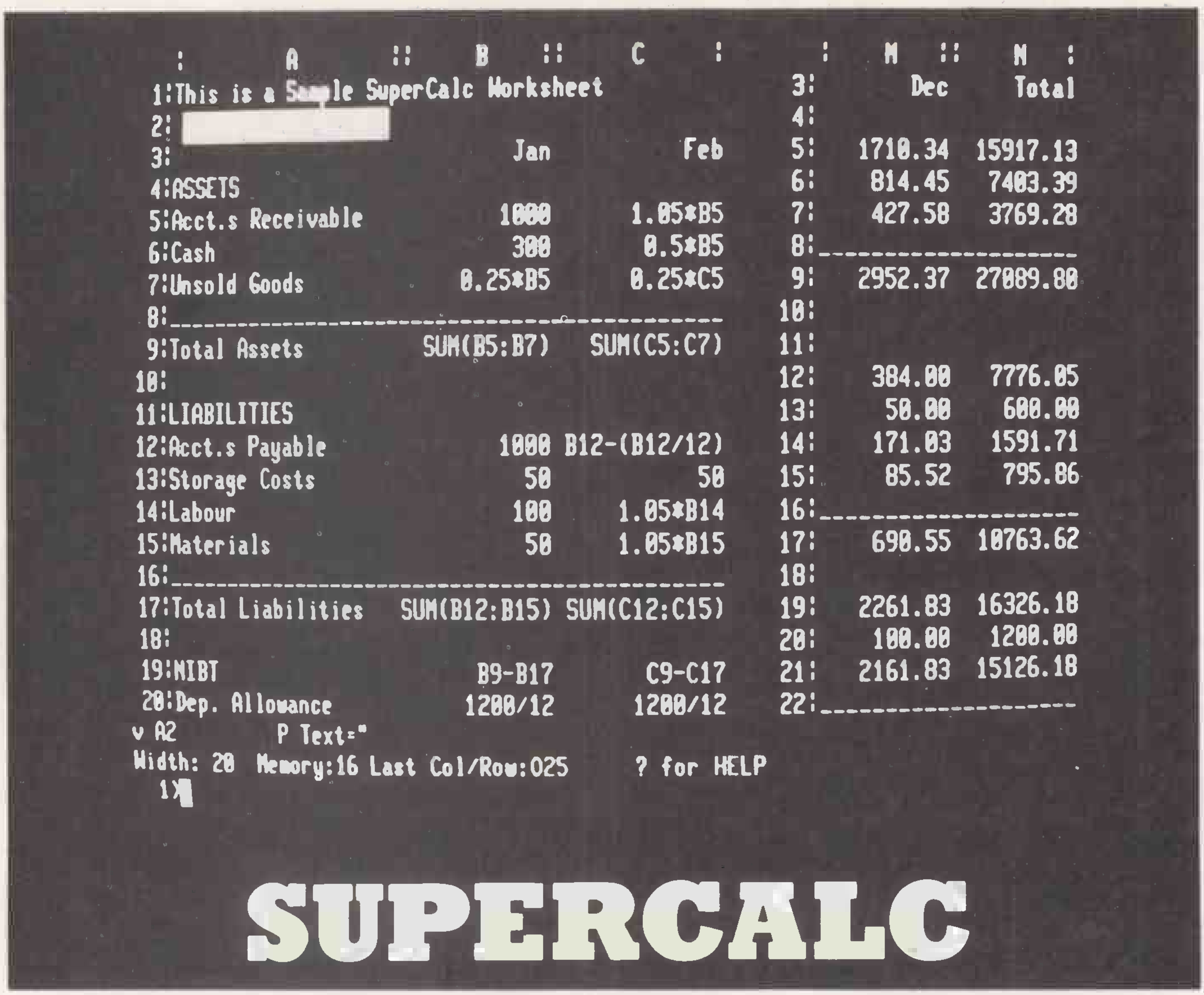


SUPERCALC

Promising to do for CP/M users what VisiCalc has done for those with 6502-based systems, this financial-planning package from Sorcim is put through its paces by Kevin Caley.

VISICALC HAS BECOME the best selling business program of all time. Apple acknowledges that many of its machines have been sold just because of VisiCalc. All this is fine if you own an Apple, Pet or TRS-80 computer, but many other computers cannot run VisiCalc, notably those which use the CP/M operating system.

Personal Software, the originator of VisiCalc, seems unlikely to produce a CP/M version, so many other companies have tried to fill the gap. A number of pretenders to the throne, have all claimed to be superior, but until now VisiCalc has had a unique advantage.

Products such as Target, T-Maker, MicroModeller and Desk Top Plan, require the user to go through a series of steps starting with designing the model on paper and progressing through a series of menus to build up the model — all before the user can even start to put in the data. Another common feature of these packages is that the operator has to use a rather complex set of instructions to set up the model.

VisiCalc was revolutionary because it allowed the computer to build up a model in the way that is familiar to almost everyone who works with figures. It lets you write down the figures as you think of them, and then rub them out when a mistake is noticed. The computer works in the same way as its operator rather than forcing users to change their ways and learn a new system.

Using the package

The program turns a computer into a combination of:

- a large piece of paper,
- a calculator,
- a pencil,
- a rubber,
- an automatic typewriter.

The "paper", or screen, is divided up into 63 columns labelled A,B,C and so on up to BK, and rows numbered from one to 254. Thus any position on the worksheet can be referred to by its co-ordinates, for example the cell in the top, left-hand corner is A1. In any cell you may type a title, a number or a formula such as A1+A4 which means "add the number in cell A1 to the number in cell A4 and put the answer here".

Error correction

If you ever have to prepare sheets of detailed figures and calculations, such as estimates or cash-flow forecasts, you will know how time-consuming it can be. After you have spent a few hours working on the figures and all the figures are just how you want them, one of three things can happen:

- Someone asks you what would happen if a particular quantity is changed, and you have to spend a considerable time changing and recalculating the figures.
- You realise that you made an important error early on that affects all your results.
- Your typist will be faced with pages of figures to type out in columns without making mistakes — and figures are far harder to check than words.

This is where VisiCalc comes into its own.

(continued on next page)

(continued from previous page)

It cannot save you much time in building your model — writing down the figures — because that is where your experience and skill come in, but if you make a mistake it can preserve your sanity by allowing you to change the figures easily.

If, for example, you decide to have a sub-total half-way down a page which has no room for one, with VisiCalc — and now SuperCalc — you simply press three keys and an extra row is automatically inserted. If you want to change a figure, you merely type over the old figure, and before your eyes the whole sheet is automatically recalculated.

Saving copies

You can save a copy of your work on disc at any time or print out your work to produce perfectly typed copies. This is ideal if you want to produce, say, a cash-flow estimate for:

- the most likely sales forecast,
- the most optimistic forecast,
- the most pessimistic forecast.

In this way, days of work can be completed in a couple of hours: an excellent example of the ability of the micro to increase productivity.

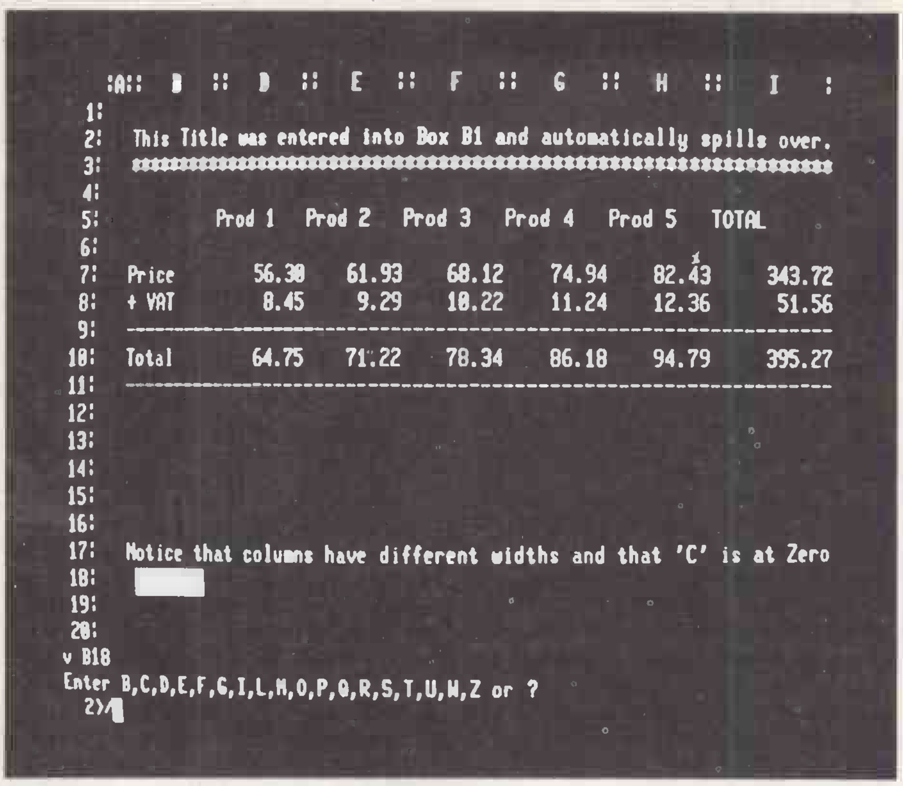
The SuperCalc program for this review was loaned by Croft Computers of Bramhall, near Manchester. It was run on a Panasonic JD-800 microcomputer with CP/M and twin 8in. floppy-disc drives. Though CP/M allows the use of a wide range of software on different computers, the software often has to be tailored to the terminal in use. If the software producer has included an installation program for your make of computer and you know how to enter the requested data, this should be straightforward. If either of these is lacking, good support from a dealer is essential.

Croft Computers has been quick off the mark in recognising the importance of SuperCalc to CP/M machines and was among the first in the U.K. to have SuperCalc working. Croft's SuperCalc user manual and quick-reference card are as good as VisiCalc's — praise indeed. The package includes the master disc, as modified by Croft, the Panasonic machine, and a card to label the Panasonic's user-definable keys with their VisiCalc functions.

Adjusting to SuperCalc

As an experienced VisiCalc user I found it easy to adjust to SuperCalc. Many of the operations are identical: "/" is used to indicate a command, and many others differ only in detail.

Though SuperCalc is, overall, a great improvement on VisiCalc it does have certain disadvantages. SuperCalc takes up more memory in the Panasonic than VisiCalc does in an Apple, but since most Apples are 48K or less and the Panasonic comes with 64K of memory, the practical difference is minimised. The maximum size of the model that can be prepared is reduced, but this will only affect the most ambitious users.



SuperCalc has been written for use on a wide range of terminals, so the visual effect will vary between computers. For example, some will show the position of the cell that is being worked on in reverse video while others will use < > for the same task. The Croft version uses reverse video as used by Apple VisiCalc. On many terminals, including the Panasonic, the first and last character in the entry cell can be obscured while the cursor is over them. SuperCalc cursor movements can be slightly slower than VisiCalc, depending on the hardware used.

Top-class printouts

On the positive side, SuperCalc allows more than one model to be loaded at once, so sub-models can be consolidated. SuperCalc allows any column to have any width from zero to 127 characters at the same time, while VisiCalc sets all columns to the same width with a minimum of three. This makes for much neater page layouts.

If you are entering a heading on a VisiCalc sheet once a cell is full, any extra characters are not shown. With SuperCalc the whole title is entered into one cell and the extra characters automatically overflow into the following cells, removing the need to rewrite the headings when the column width is changed and allowing more sophisticated headings.

SuperCalc allows the screen to display not only all the values but, alternatively, all the formulae, with or without the borders indicating the co-ordinates. The sheet can then be printed out in the format shown on the screen.

SuperCalc has a unique command /P which protects the contents of a cell or a range of cells from change. Commands will operate on surrounding cells but leave protected cells unchanged. By pressing the ? key at any time, SuperCalc will present its user with a full screen of information and hints, without losing any data.

It is not easy to disguise the fact that an Apple VisiCalc printout has been produced by computer rather than a typist. It has no lower-case letters, no pound sign on the keyboard, and it cannot draw solid, horizontal lines. The Panasonic has a more comprehensive character set, and SuperCalc printouts can be made to look as if they have been typed.

Conclusions

- **Owners of CP/M machines need no longer feel inferior and change the subject to WordStar when Apple and Pet owners talk about VisiCalc.**
- **SuperCalc is equal or superior to VisiCalc in every important feature.**
- **Because SuperCalc and VisiCalc allow users to apply methods with which they are already familiar, they are both much easier to learn than any competing program.**
- **Anyone who has used VisiCalc will quickly feel at home with SuperCalc.**
- **SuperCalc is produced by Sorcim Corporation, 405 Aldo Avenue, Santa Clara, California; it is available from Encotel Systems, 530-539 Purley Way, Croydon, Surrey. Telephone 01-686 9687. SuperCalc costs £185.**

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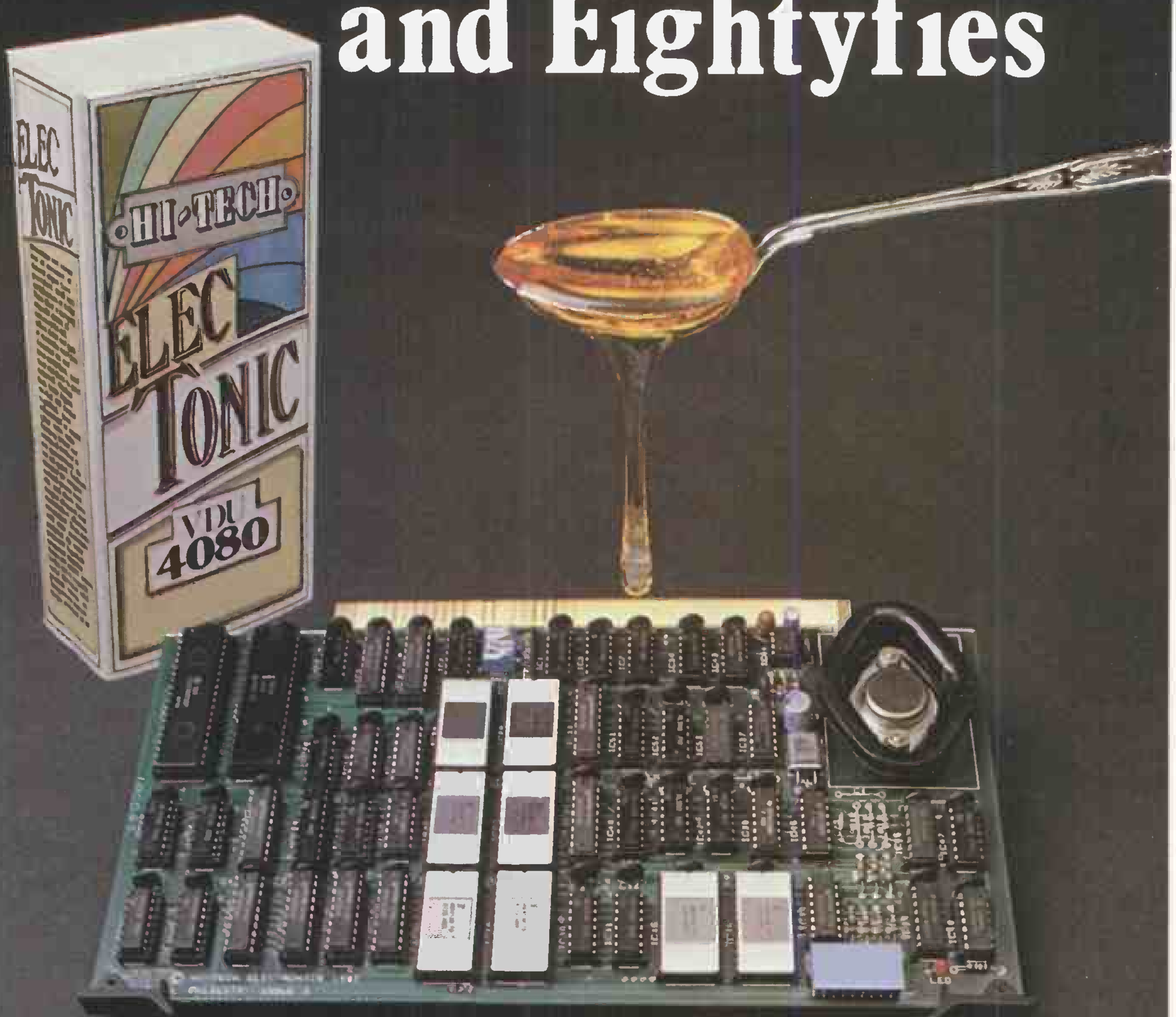

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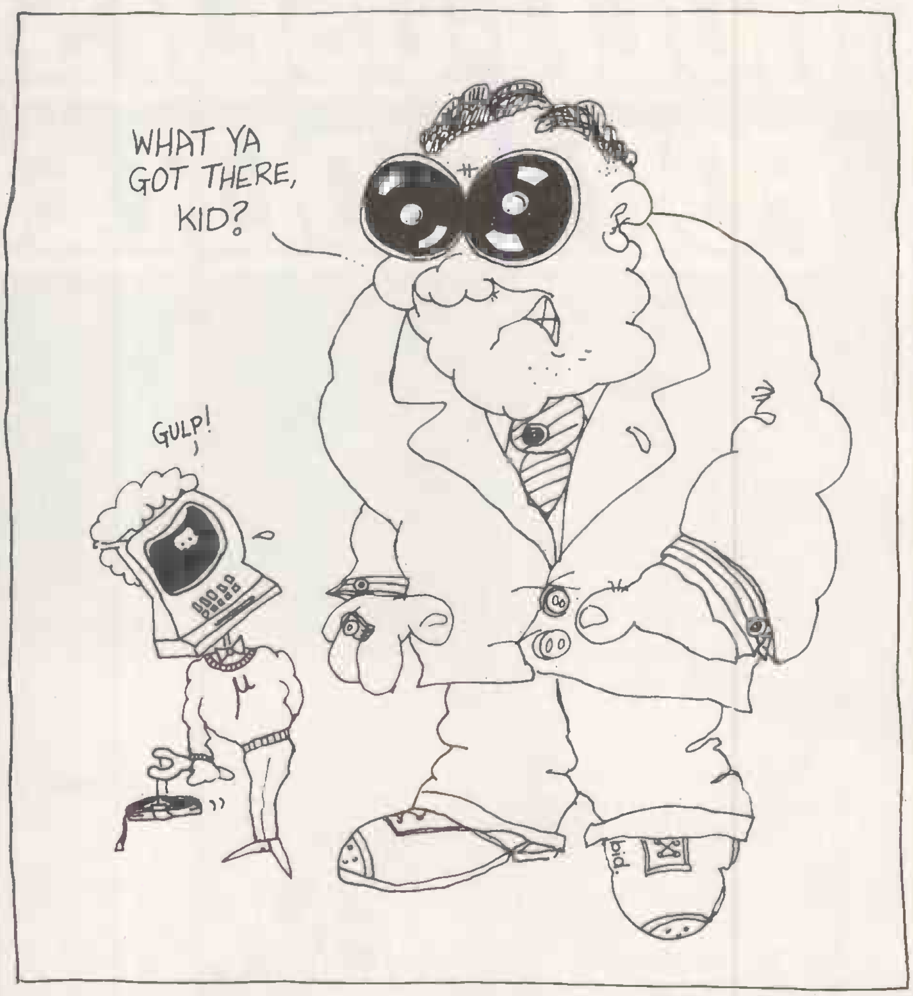
How will the giants react to the micro?

The mainframe manufacturers are finding that microcomputers — so recently derided as mere toys — are making inroads into their hitherto safe preserves. Clare Gooding examines their contrasting styles, and ponders on how the giant mainframe builders will fare among the quick-witted bandits of the micro world.



TIME WAS when anyone working with computers had a hard time at social gatherings. If you were foolish enough to admit it, the reaction was either "Oh that's all too technical for me, don't know anything about it", or worse, an inundation of stories about payroll computer errors and gas bills for £0.00. Nowadays a more likely reaction is, "We've got one of those at work, amazing little machine, we do everything on it".

The computer, that great mystical, rather threatening beast, has become less remote, and almost respectable. The amazing little machine is likely to be a microcomputer. Those who dismissed Pets, Apples and Tandys as hobbyists' toys now find them so ensconced in the business world that they speculate whether micros will eventually replace the mainframe.

The key to the rapid progress of the micro has been software availability. Instead of being limited to the programs sold by their friendly dealer, people have also written their own software.

A few years ago this would have been tantamount to blasphemy. The micro was still considered an experimental freak, nothing to do with real computing, except by an enlightened few who set about linking micros with larger "host" machines to make software development possible in a more familiar environment.

Amateur beginnings

Software houses such as CAP and Logica, who had made their killing on huge mainframe projects, were already fiddling with micros in attics and basements. At the same time do-it-yourself hobbyists began to discover the joys of Basic. Even if the results were far from perfect, they provided an alternative to the turnkey products at a price small users could afford.

As for the hardware, new potential users thought they could afford a micro where previously a bureau service or a larger machine of their own would have been out of the question.

The mini paved the way for the micro as companies like Hewlett-Packard and Wang offered cheaper hardware solutions, but the nature of software production stayed much the same. The micro arrived when the pattern of the computer market was changing in any case. Software was beginning to play a larger part, although a firm wanting to computerise would still look first at the hardware it wanted, and then find a software house or a package through the manufacturer.

In the old days someone somewhere in an organisation would realise that a computer might make the company more efficient, by doing payroll and perhaps more specialised company-related tasks.

A consultant might move into the company, spending some weeks getting familiar with existing routines. If the hardware itself had not been chosen it might be his job to specify the machine as part of the system design.

Usually an existing manual system would provide the skeleton, and some constraints, for the eventual computerised application. The consultant would confer with the systems analyst, who would translate the entire system into separate modules or programs.

Ample documentation

Each program had its own design document, a specification which set out the size and names of fields, the layout of report printouts, and so on. These were probably passed on to a fairly large team of programmers.

It was perfectly possible for programmers never to know the clients' original aims for the system. They could spend all day shoving fields and values around without knowing what they represented: their prime concerns were, not surprisingly, far removed from those of the client company.

In the mid-seventies there were still some hangovers from the days when software had been of secondary importance and even given away free with hardware. Programmers took great pride in tweaking: devising clever routines which would run more efficiently in hardware terms.

The problem with clever-clever programming was that, however efficiently it ran, when it came to changing it or debugging at a later date no-one else could decipher what the whizz kid had thought up.

Changing skills

As hardware prices began to drop, programming became increasingly important. In most large software houses programmers were taught that documentation was essential and that all development programming should bear future maintenance in mind.

Turnkey projects became less common as companies accepted package solutions to data-processing problems. Tailoring packages to individual requirements was easier and more profitable with well-structured and documented programs than when programmers had given variables names like Fred.

All this meant a shift of skills. Specialisation had been essential before because of the size and complexity of systems. The jigsaw of hardware operating system and programming language in a specific system design called for inside knowledge at different levels.

With big data-processing shops the job of operator was, and still is, a separate skill demanding familiarity with the ins and outs of large-scale systems software. But in the small company — a first-time user or one which had perhaps relied on a bureau before buying its own machine — the roles would be merged.

On every desk

The end-users might be people who had been with the company for some time, familiar with the business and possibly the manual system which had preceded the computer. Often operating the machine formed only a small part of their duties and it would be a matter of teaching them to treat the new system as a tool.

The new small-business systems were within the reach of many more businesses than the mainframes with their special premises and team of attendants. The mystique began to be dispelled as people saw small computers being installed in their own office premises — not behind closed doors, with special under-flooring and cooling systems, but in the same corridor, and under the care of Brenda-who-has-been-here-for-years.

When the microcomputer burst through the pages of the Sunday colour supplements into homes and businesses the old mystery was really polished off. People discovered that it was possible

to learn Basic and write programs. Operating systems like CP/M meant that people could manage their own machines, and the market realised that applications written for particular machines and operating systems in the micro market were saleable.

Computers were more widely used than ever before, and end-users expected better service, more for their money, and even access to their own information — logical enough, but impossible in the days when hardware had been so expensive that the computer had to be carefully tuned to maintain performance per penny.

Handing over power to end-users can hamper the absolute performance of the machine, but makes the people more valuable because their time is spent more efficiently. In the eighties, this has become the important part of the employment equation. People are becoming more aware of computerisation than they were when their pay slip and bank statement were the closest they ever got to a computer.

While the "Noddy programs" gather dust, the new and sophisticated applications of the micro have forced the data-processing business to take notice. Microcomputers have long been part of the furniture in universities and colleges, and they have already proved their worth at departmental level in large companies like Shell.

Those in the DP industry who had been inclined to dismiss the microcomputer as little more than a toy, far removed from real computing, have had to re-evaluate. Nonetheless software houses recognised the limitations of Basic, the native language of the average micro.

Too many people had pushed out software which worked for them, without realising how easy it is to bomb software if it does not cater for all sorts of errors. It is easy enough to write a routine to do a particular job, but much more difficult to make it watertight, bug-free and easy for the user to work with.

Powerful tools

Micro packages became freely available but they sometimes lacked quality. Some needed extensive testing by the user and others were just so limited in power that users would become exasperated and look for something else.

The micro software market went through a similar learning cycle to the mainframe and minicomputer markets except that microprocessors could be linked to big host machines where the software could be developed before being run on the micro.

This gave access to the more powerful and sophisticated techniques of programming, particularly high-level languages. The more enterprising software houses concentrated on supplying those tools to the micro, and gradually Pascal, Cobol, Algol, APL and RTL/2, all highly "professional" languages, began to emerge on micros.

The other big problem was lack of sheer size and power. Even if you were

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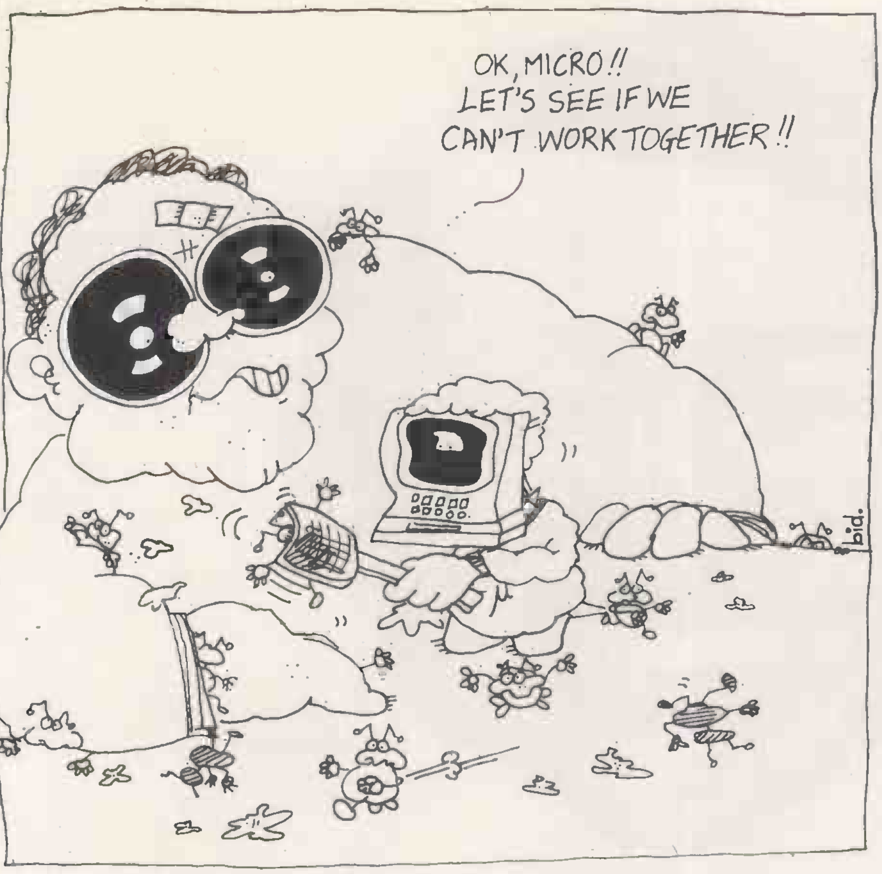

(continued from page 85)

lucky enough to find watertight software, the limitations of the floppy disc made themselves apparent pretty quickly if the micro was running several applications, rather than just one.

By this time, software experts whose roots were in the traditional data-processing world were well aware that the micro offered opportunities which made working in a Cobol shop with a mainframe dull by comparison. Thoroughly professional software tools, like the CIS Cobol compiler from MicroFocus, complete with development aids, had been produced. Far from dismissing the micro as a toy, most professional programmers became enthusiastic and realised that their skills were not necessarily obsolete.

The gap narrows

Everything had grown up a little since the original eight-bit micro. Technology had moved on, and hard discs solved the storage problem for microcomputers. Winchester-type hard discs, such as Corvus, meant no more fiddling around changing floppies and squeezing data into overflowing spaces.

The 16-bit machines that have been appearing on the market in the last year or so are not far removed from minicomputers. As well as mass storage, operating systems cater for multi-users, offering the kind of facilities that used to be associated more with mini and mainframe machines.

Manufacturers had learnt the importance of operating systems to machine and software sales from the immense popularity of CP/M. In the eight-bit market, people wrote applications which ran with CP/M simply because it had the reputation of offering a wide choice of software. The cycle perpetuated itself: people bought CP/M machines because they knew that there was plenty of CP/M software out there, and programmers, sure of their market, went on writing it.

Even Digital Research, the small systems house which originated CP/M, admits that it was not necessarily the best operating system. It was ready and available when people needed it, and became recognisable and familiar. Just how tight a grip it now has is evident in that even on the more powerful 16-bit machines of the next generation, customers are asking for CP/M to be implemented, much to the amusement of those who have nurtured new operating systems into being so that the new machines can make the most of their extra power.

There is a wealth of indepenently-written software applications on tap to CP/M, with a range and choice which would bewilder most mainframe pundits. As a result, the micro manufacturers have evolved a different method of doing business from the original "here's the hardware and you'd better stick to us for the software" technique. Most micro manufacturers did not attempt to supply applications. Hardware dealers could refer buyers to whole lists of independently-written software.

This off-the-shelf method of selling software like soap powder from a supermarket works far better in the micro environment than it ever did with the large machines, though there are major differences in the two markets.

To make a profit, micro software distributors have to sell in volume, and the customer has to take it or leave it. There is no question of elaborate tailoring for each customer, and packages have to be robust enough to stand on their own with the minimun of maintenance. Documentation and operating instructions have to be of a standard that would allow a comparatively naive first-time user to get the package up and running entirely on his own.

If the package does not work, or if there are problems in sorting it out, it is probably cheap enough to be thrown away. The price of the microcomputer itself has always put an upper limit on the cost of the software, however brilliantly devised and written.

In the mainframe market there can be no question of "disposable software". It is not unusual for a full suite of financial and payroll programs, or perhaps a set of development aids, to cost well over £20,000. High initial prices are followed by heavy maintenance costs.

Large packages require constant maintenance. Payroll packages need instant updating as laws and tax regulations change. Most micro packages, if they receive any maintenance at all, will be updated through the post.

Weak excuses

Often the end-user now has control of parameters and can do a certain amount of housekeeping maintenance, but the onus is still on the supplier to make sure that software is bug-free.

Large systems for mainframes involve a lot of high-level language programming, but with high-level languages now as much in evidence on micros as on mainframes, the excuse that such programming skills are expensive can hardly account for the difference in the cost of software.

Mainframe installations do demand more skills at all the different "layers" of software. The mammoth operating systems of mainframes make writing them far more difficult than when dealing with TRSDOS or CP/M. Doctors or shopkeepers writing their own applications can be their own consultant, but for mainframes the role of consultant and the systems analyst remain vital. The system has to run efficiently, which may involve a systems programmer as well as the operator. No wonder it becomes expensive.

The mainframe market has been hampered by its complex and grossly inefficient operating systems, conceived when giving power to the end-user was out of the question, and portability to be

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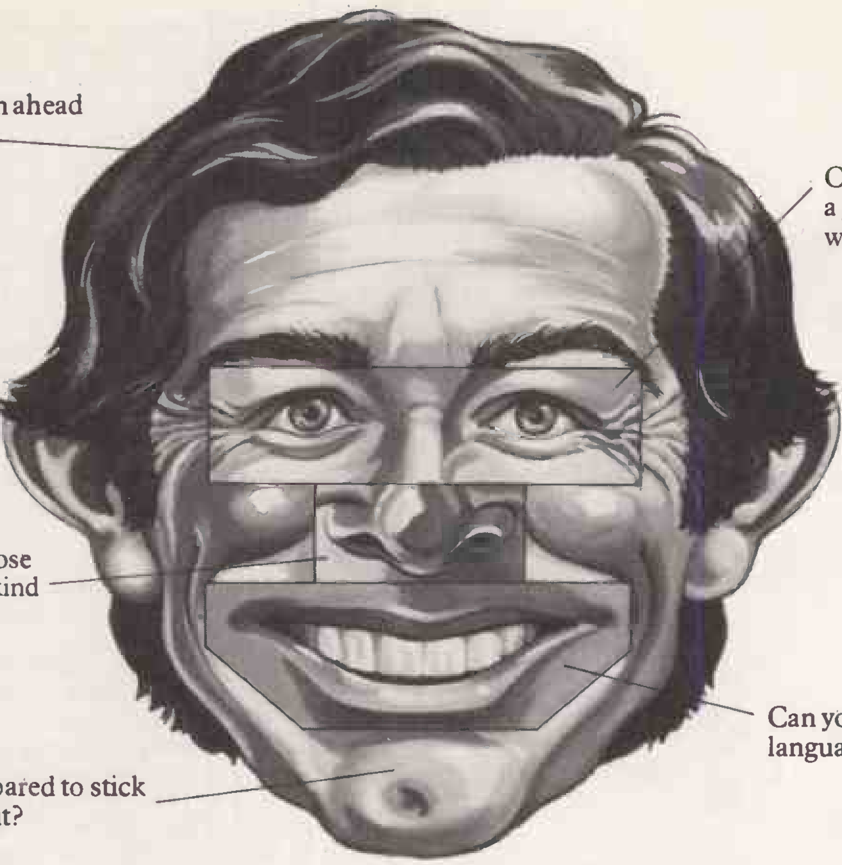

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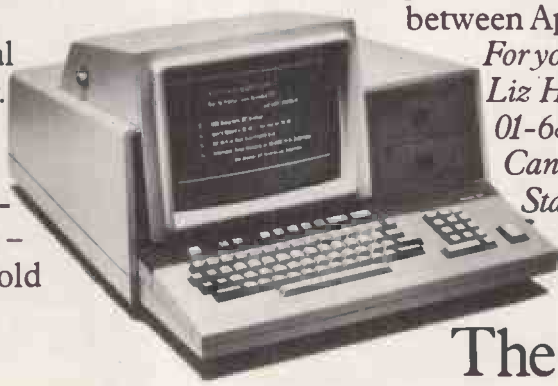

Canon

The next step forward

● Circle No. 162

(continued from page 87)
avoided, since the manufacturer was anxious to keep his users well and truly locked in to his equipment.

The micro market proved that software portability was likely in the long run to benefit everyone since the more software is available, the more likely hardware is to sell, especially as the software decision has become the crucial part of buying a system. The choice of Unix, the time-sharing operating system from Bell, for some 16-bit machines has opened up the possibility of software applications portable between micro and mainframe because mainframe manufacturers are also adopting Unix.

A lesson learned

Miraculously, the big boys seem to have learnt the lessons of the micro market. IBM finally put the stamp of respectability on micros by launching its own 16-bit machine last year with outside-written hardware: quite a U-turn for the company which originated the idea of lock-in operating systems and hairy system conversions.

IBM picked CP/M-6, and promises total compatibility with CP/M. Other applications were announced; Peachtree, for example, was approached for its financial packages to be supplied as the standard software applications with the IBM Personal Computer.

Software publishing, which gives the same service to program authors as book publishers give to novelists, has become the in thing in microcomputing. Caxton Software Publishing, which claims to be the first such London publisher, puts enormous emphasis on the quality of presentation.

The mini and mainframe markets are taking note, and organisations like Wang now actively encourage independent software suppliers. Even IBM looks with favour on suppliers of "alternative" applications.

Micros have made end-users more demanding. Data-processing managers can no longer ignore micros. The user who would once docilely accept a six-month wait for his application is now more likely to go out to buy a micro for his department.

The idea of de-skilling the use of a computer had already won acceptance in the micro field: soon people wanted to get their hands on the mainframe, too. This change was really just a process of moving the skills one step up the line. Programmers had to write software which was that much more clever so that users did not need to be.

Now the ultimate user-friendly tools are being developed at the mainframe end: speech synthesis and interpretation, expert systems, and natural-language systems which allow the users to communicate with the computer on their own terms. Some of these products, the result of artifical-intelligence research, are already being sold, but they are notoriously power-hungry and would chew up the processing power of a micro before you could do a syntactical analysis of Jack Robinson.

Not forgetting the matter of existing investment, mainframes are unlikely to be pushed out by micros simply because their immense processing power is still needed for the everyday running of companies. The micro excels as a flexible tool for the end-user, but the mainframe is still needed for the dirty work: the corporate processing of payroll and accounts.

The next step

Those micro users who declared UDI with their own departmental machine are beginning to discover that it would be very useful to be able to tap into the mainframe sometimes, for data, or sheer processing power. And the mainframes can get on with number crunching or data chewing far more efficiently if relieved of all those specialised applications. The next big issue for the computer community will be networking and telecommunications. If we can get it right, both micros and mainframes will find their niche in systems where the quality of the job matters more than the size of the mill.

Whitehall and the corridors of power

Solve the toughest Parliamentary imbroglio with Whitehall, Simon Goodwin's political game.

WHITEHALL is a game of political intrigue, written in Apple integer Basic for a computer with at least 8K of memory. The player takes on the role of an ambitious Member of Parliament and attempts to rise from the rank of parliamentary private secretary through the Foreign Office to Prime Minister, by judiciously deciding how much time should be spent in parliament, in the constituency, or attending to committee or ministerial responsibilities.

Each decision is closely scrutinised by the people affected. If an MP neglects his duties he may have to contend with public enquiries, international scandals, or votes of no confidence. Tricky policy decisions have to be made each year, on issues such as foreign aid and accepting refugees. Periodically the MP has to justify his pay increase to the electorate — and every few years he must face a general election. A narrow defeat can be challenged by calling for a recount — but remember you are only allowed one at each election.

The various party names were invented before the advent of the SDP so no inferences should be drawn from the assignment of the player to the Democratic party. It would be simple to change the listing to ensure that you always represent a favourite real political party.

An opinion poll is displayed each year, estimating the degree of support offered by fellow MPs and the electorate, and the state of your morale. Sooner or later your immediate superior is taken ill or decides to retire, in which case you must attempt to gain promotion. Beware of being pushed upstairs into the House of Lords once you have reached respectable rank.

The Whitehall program should run, with a few modifications, on any microcomputer with a Basic interpreter and at least 8K of memory. Some of the print formatting may need to be changed if you are not using a 40-column display. The Basic used is integer only, so a few Int statements may be needed to prevent ridiculous displays — for example, the loss of an election by 0·25 of a vote.

The Apple Rnd function is slightly

(continued on next page)

```
 90 DIM A$(10)
100 TEXT : CALL -936: REM  CLEAR VDU
110 PRINT "****************************************"
120 PRINT "*                                      *"
130 PRINT "*           W H I T E H A L L          *"
140 PRINT "*                                      *"
150 PRINT "*      GAME (C) 1980 S.N. GOODWIN.     *"
160 PRINT "*                                      *"
170 PRINT "****************************************"
175 FOR D=0 TO 1000: NEXT D
180 PRINT : PRINT "DO YOU KNOW THE RULES?"
190 INPUT A$: IF A$(1,1)#"Y" THEN 1800
198 REM
199 REM  INITIALISE *****
200 H=40+ RND (21):E=35+ RND (31)
210 M=45+ RND (21)
220 T=0:A=0:R=1
230 CALL -936: REM  CLEAR VDU
298 REM
299 REM  MAIN LOOP *****
300 T=T+1:A=A+1
310 PRINT : PRINT
320 TAB (16): PRINT "YEAR ";T: PRINT
330 IF T<30+R+ RND (6+R) THEN 370
340 PRINT "WELL DONE, SENILE... YOUR CONSTITUENCY  PARTY 'ENCOURAGE'
     YOUR RETIREMENT FROM  PARLIAMENT."
350 GOTO 2000
360 PRINT "TOTAL MUST ADD UP TO 20": PRINT
370 INPUT "ENTER MINISTERIAL DUTIES ",D: PRINT
380 INPUT "ENTER CONSTITUENCY DUTIES ",C: PRINT
390 INPUT "ENTER PARLIAMENTARY DUTIES ",P: PRINT
400 IF D+P+C>20 THEN 360
410 F=20-D-P-C
420 PRINT "REMAINDER (FAMILY DUTIES) ";F: PRINT
430 IF A=5 OR A=4+ RND (2) THEN 1500
440 IF A# RND (30) THEN 470
450 PRINT "CRISIS !! EARLY ELECTION FORCED UPON    GOVERNMENT."
    : PRINT
460 GOTO 1500
470 REM  CRISIS, WHAT CRISIS ?
498 REM
499 REM  CALCULATIONS *****
500 H=H*((D-5)+(P-5)*2)/50+H-1
510 IF H>100 THEN H=100- RND (15)
520 IF H<0 THEN H= RND (6)
530 E=E*((C-5)*3+(D-5)+(P-5)+(M-50)/5)/150+E-A+C-1
540 IF E>100 THEN E=99- RND (10)
550 IF E<0 THEN E= RND (3)
560 M=M*((F-5)*3+(E-40)/10+(H-50)/10)/100+M-A
570 IF M>100 THEN M=100- RND (5)
580 IF M<0 THEN M= RND (15)
590 GOSUB 1300
598 REM
599 REM  PRESET EVENTS *****
600 IF D> RND (4) THEN 640
610 PRINT "PARLIAMENT IS CONCERNED ABOUT YOUR      MINISTERIAL PERFO
    RMANCE."
620 PRINT "A PUBLIC ENQUIRY IS SET UP TO CHECK     YOUR ACTIVITIES."
    : PRINT
630 E=E*14/15:M=M*12/13:H=H*8/9
640 IF C> RND (5) THEN 720
650 PRINT "YOUR LOCAL PARTY ARE ANNOYED ABOUT YOUR ATTITUDE."
660 PRINT "THEY STAGE A VOTE OF NO-CONFIDENCE.": PRINT
```

(listing continued on next page)

(continued from previous page)
unusual. Rnd(3) returns 0, 1 or 2 at random, and so forth. If your computer has a function of the form Rnd(0) which returns a value between 0 and 1 then you can replace Rnd(N) by

INT(RND(0)*N)

Text in line 100 selects the display of text rather than graphics on the screen. Call −936 activates an Apple monitor routine which clears the screen and the hash sign used in If statements corresponds to <>, meaning not equal, in standard Basic.

The vertical line in 1570 is an exponential symbol, and is entered as shift-N on the Apple keyboard. Most computers use an upward arrow or two asterisks to denote this function. The patriotic Teletype persists in printing string variables as pound signs rather than dollars.

The only string variable used by the program is A$, which is declared to have a maximum length of 10 characters in line 90. Most Basic interpreters will not require this statement. The expression A$(1,1) which returns the first character of the string A$ could alternatively be written as

LEFT$(A$,1)

The Apple Tab function is not used inside a Print statement. Hence the function Tab(9) causes the computer to print the next text on the ninth column of the display. Beware of integer Basic If statements — only the statement immediately following the If is conditional to it, so that the line

100 A = 9 : IF A = 8 THEN A = 7 : A = 0

leaves A with the value zero. Other functions and statements in the program are in standard Microsoft Basic form.

F: Family duties
D: Ministerial duties
C: Constituency duties
P: Parliamentary duties
M: Player's morale
H: Support in the House
C: Constituency support
A$: General-purpose string
T: Year number in career
A: Year number since election
R: Player's rank
J,Y: General purpose
X: Time delay

Whitehall is not intended as a serious simulation of life in the corridors of power, but despite a few weaknesses I have found it addictive. The player is never out of office, for instance — but perhaps he would have lost his seat if the party went into opposition, or maybe, like Churchill, transferred allegiance at an opportune moment. Some players may subscribe to the cynical view that politicians behave in much the same way whether they are in power or not.

It seems fitting to leave the last word to a former Cabinet minister who himself changed parties during his career. At a meeting of constituents he was reported to have praised the National Health Service with the words, "I have spent several days visiting mental hospitals, and found myself completely at home".

(listing continued from previous page)

```
670 J=31-E/3-C: IF J<1 THEN J= RND (3)
680 PRINT "VOTES IN YOUR FAVOUR ....          ";31-J
690 FOR X=0 TO 700: NEXT X
700 PRINT "VUTES AGAINST YOU ....          ";J: PRINT
710 E=E*32-J/31:M=M*(J+30)/60
720 IF P> RND (4) THEN 760
730 PRINT "MAJOR INTERNATIONAL SCANDAL OVER "
740 PRINT "BRITISH GOVERNMENT DISORGANISATION.": PRINT
750 M=M*10/11:H=H*15/16:E=E*13/14
760 IF F> RND (4) THEN 800
770 PRINT "FAMILY CRISIS LEAKED TO MEDIA."
780 PRINT "CONSIDERABLE BAD PUBLICITY GENERATED.": PRINT
790 M=M*3/5:E=E*12/13:H=H+ RND (7)-3
798 REM
799 REM  RANDOM EVENTS *****
800 J= RND (10): IF J=0 THEN 900
810 IF J=1 THEN 950
820 IF J=2 OR J=5 THEN 1000
830 IF (J=3 AND R#9) OR (J=3 AND T>30) THEN 1060
840 IF (J=4 AND R#9 AND T>6) OR (J=4 AND T>30) THEN 1070
850 PRINT "GENERALLY AN UNEVENTFUL YEAR.": PRINT
860 GOTO 1200
900 PRINT "FAMINE IN THE FAR EAST.": PRINT
910 PRINT "DO YOU SEND AID ?": PRINT
920 INPUT A£: IF A£(1,1)#"Y" THEN 940
930 E=E*(30- RND (11))/25:M=M*10/9:H=H*10/11: GOTO 1200
940 E=E*(30- RND (21))/25: GOTO 1200
950 PRINT "FOREIGN REFUGEE CRISIS.": PRINT
960 PRINT "WILL YOU ACCEPT IMMIGRANTS ?": PRINT
970 INPUT A£: IF A£(1,1)#"Y" THEN 990
980 E=E*(30- RND (11))/25:M=M*10/9: GOTO 1200
990 E=E*(30- RND (21))/25:H=H*13/12: GOTO 1200
1000 PRINT "TIME FOR A PAY INCREASE FOR M.P. S ? ": PRINT
1010 PRINT "WHAT INCREASE DO YOU SUGGEST(%) ?":J= RND (5)
1020 PRINT : PRINT "ELECTORATE SUGGEST ";J*3+5;" %"
1030 PRINT "SOME M.P. S WANT ";J*5+20;" %": PRINT
1040 INPUT X:E=E+(J*4+6)-X
1050 M=M-(J*4)+X:H=H-(J*4+6)+X: GOTO 1200
1060 PRINT "YOUR SUPERIOR IS SUDDENLY TAKEN ILL.": GOTO 1080
1070 PRINT "YOUR SUPERIOR DECIDES TO RETIRE."
1080 PRINT "WILL YOU TAKE HIS PLACE... ?": PRINT
1090 FOR X=0 TO 800: NEXT X
1100 IF H+M*5> RND (70)+40 THEN 1120
1110 PRINT "YOU KEEP YOUR PRESENT POSITION.": GOTO 1400
1120 PRINT "YOU SUCCEED: NEW RANK ";:R=R+1: GOTO 1400
1198 REM
1199 REM  END OF LOOP *****
1200 IF H>100 THEN H=100- RND (15)
1210 IF H<0 THEN H= RND (6)
1220 IF E>100 THEN E=99- RND (14)
1230 IF E<0 THEN E= RND (3)
1240 IF M>100 THEN M=99- RND (5)
1250 IF M<0 THEN M= RND (10)+2
1260 GOSUB 1300
1270 GOTO 300
1280 REM
1290 REM
1298 REM
1299 REM  REPORT *****
1300 PRINT "        CURRENT OPINION POLL.": PRINT
1310 PRINT "ELECTORATE SUPPORT ";E;" %"
1320 PRINT "SUPPORT OF M.P. S  ";H;" %"
1330 PRINT "YOUR MORALE RATING ";M: PRINT
1340 IF M> RND (30) THEN 1370
1350 PRINT "URGH! YOU DECIDE TO RESIGN FOR PERSONAL REASONS."
1360 GOTO 2000
1370 FOR X=0 TO 1000: NEXT X
1380 RETURN
1398 REM
1399 REM  RANK *****
1400 IF R#1 THEN 1410: PRINT "PARLIAMENTARY PRIVATE SECRETARY.":
   GOTO 1480
1410 IF R#2 THEN 1420: PRINT "PARLIAMENTARY SECRETARY.": GOTO 1480

1420 IF R#3 THEN 1430: PRINT "JUNIOR MINISTER.": GOTO 1480
1430 IF R#4 THEN 1440: PRINT "CABINET MINISTER.": GOTO 1480
1440 IF R#5 THEN 1450: PRINT "SECRETARY OF STATE.": GOTO 1480
1450 IF R#6 THEN 1460: PRINT "PRIME MINISTER.": GOTO 1480
1460 PRINT "LIFE PEER - YOU ARE 'PROMOTED' TO THE   HOUSE OF LORDS."

1470 PRINT "YOUR CAREER IS OVER.": GOTO 2000
1480 PRINT : GOTO 1200
1498 REM
1499 REM  ELECTION *****
1500 PRINT "A GENERAL ELECTION IS CALLED.": PRINT
1510 PRINT "WILL YOU STAND FOR 'DEMOCRAT'          RE-ELECTION?"

1520 INPUT A£: IF A£(1,1)#"Y" THEN 2000
1530 PRINT : PRINT "RESULTS ARE COMING THROUGH.";
1540 FOR X=1 TO 6: FOR Y=1 TO 300
1550 NEXT Y: PRINT ".";: NEXT X
1560 PRINT : PRINT
1570 A=25000-(E*260)- RND (400)-(R ↑ 4)
1575 IF A<1000 THEN A=1000+ RND (1000)
1580 PRINT "LOYALIST PARTY              ";A
1590 FOR X=0 TO 500: NEXT X: PRINT
1600 PRINT "PROGRESS PARTY              ";400+ RND (200)
1610 FOR X=0 TO 700: NEXT X: PRINT
1620 PRINT "BIRTHDAY PARTY              ";25000/365
1630 FOR X=0 TO 900: NEXT X: PRINT
1640 PRINT "ENTROPY PARTY               "; RND (200)
1650 FOR X=0 TO 1100: NEXT X: PRINT
1660 PRINT "DEMOCRATIC PARTY (YOU)      ";25000-A
1670 FOR X=0 TO 1300: NEXT X
1680 IF A>12500 THEN 1700
1690 PRINT "WELL DONE.": PRINT :A=0: GOTO 500
1700 PRINT "YOU SEEM TO HAVE LOST!"
1710 PRINT "DO YOU DEMAND A RECOUNT?"
1720 INPUT A£: IF A£(1,1)#"Y" THEN 2000
1730 IF Y#300 THEN 1740
1735 PRINT "SORRY, NOT ANOTHER!": GOTO 2000
1740 Y=300: PRINT : PRINT "O.K. HERE GOES...."
1750 FOR X=0 TO 900: NEXT X
1760 GOTO 1560
1798 REM
1799 REM  GAME RULES *****
1800 CALL -936: REM  CLEAR VDU
1810 PRINT "          WHITEHALL   GAME RULES": PRINT
1820 PRINT "YOU START THE GAME AS A PARLIAMENTARY   PRIVATE SECRETARY
   , AND AIM TO RISE      TO THE RANK OF"
1830 PRINT "PRIME MINISTER BY MAKING DECISIONS      ABOUT HOW MUCH TI
   ME YOU SPEND ON THESE  ACTIVITIES :": PRINT
1840 PRINT "          1. PARLIAMENTARY DUTIES."
1850 PRINT "          2. MINISTERIAL RESPONSIBILITIES"
1860 PRINT "          3. CONSTITUENCY DUTIES."
1870 PRINT "          4. FAMILY RESPONSIBILITIES.": PRINT
1880 PRINT "YOU HAVE 20 POINTS TO SPLIT BETWEEN      THESE EACH YEAR."

1890 PRINT "YOU MAY BE CALLED UPON TO MAKE POLICY   DECISIONS AS PLAY
    PROCEEDS.": PRINT
1900 PRINT : PRINT "READY FOR PAGE 2 ?";: INPUT A£
1910 CALL -936: REM  CLEAR VDU
1920 PRINT "WHITEHALL GAME RULES : SECOND PAGE.": PRINT
1930 PRINT "YOUR DECISIONS WILL DETERMINE THREE      QUANTITIES - IF A
   NY ONE FALLS TOO LOW   THE GAME ENDS.": PRINT
1940 PRINT "         1.PERSONAL MORALE."
1950 PRINT "         2.PARLIAMENTARY SUPPORT."
1960 PRINT "         3.ELECTORATE SUPPORT.": PRINT
1970 PRINT "GOOD LUCK": PRINT
1980 PRINT "READY TO START? ": INPUT A£
1990 GOTO 200
1998 REM
1999 REM  END OF GAME *****
2000 FOR X=0 TO 1599: NEXT X
2010 CALL -936: REM  CLEAR VDU
2020 TAB (15): PRINT "GAME OVER.": PRINT
2025 TAB (9): PRINT "YOU LASTED ";T;" YEARS.": PRINT
2030 PRINT "TYPE YES IF YOU WOULD LIKE TO PLAY AGAIN."
2040 INPUT A£: IF A£(1,1)="Y" THEN 100
2050 PRINT : PRINT "PROGRAM END."
2060 END
```

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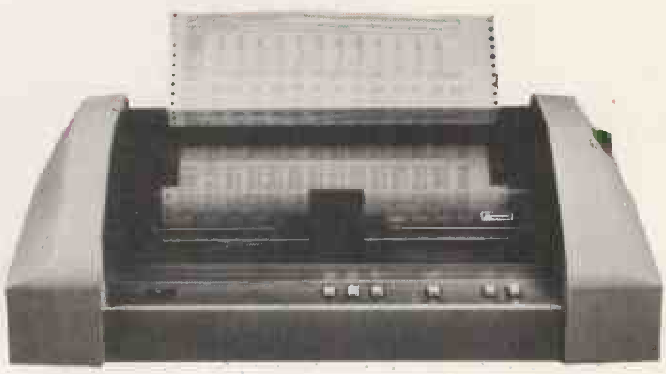

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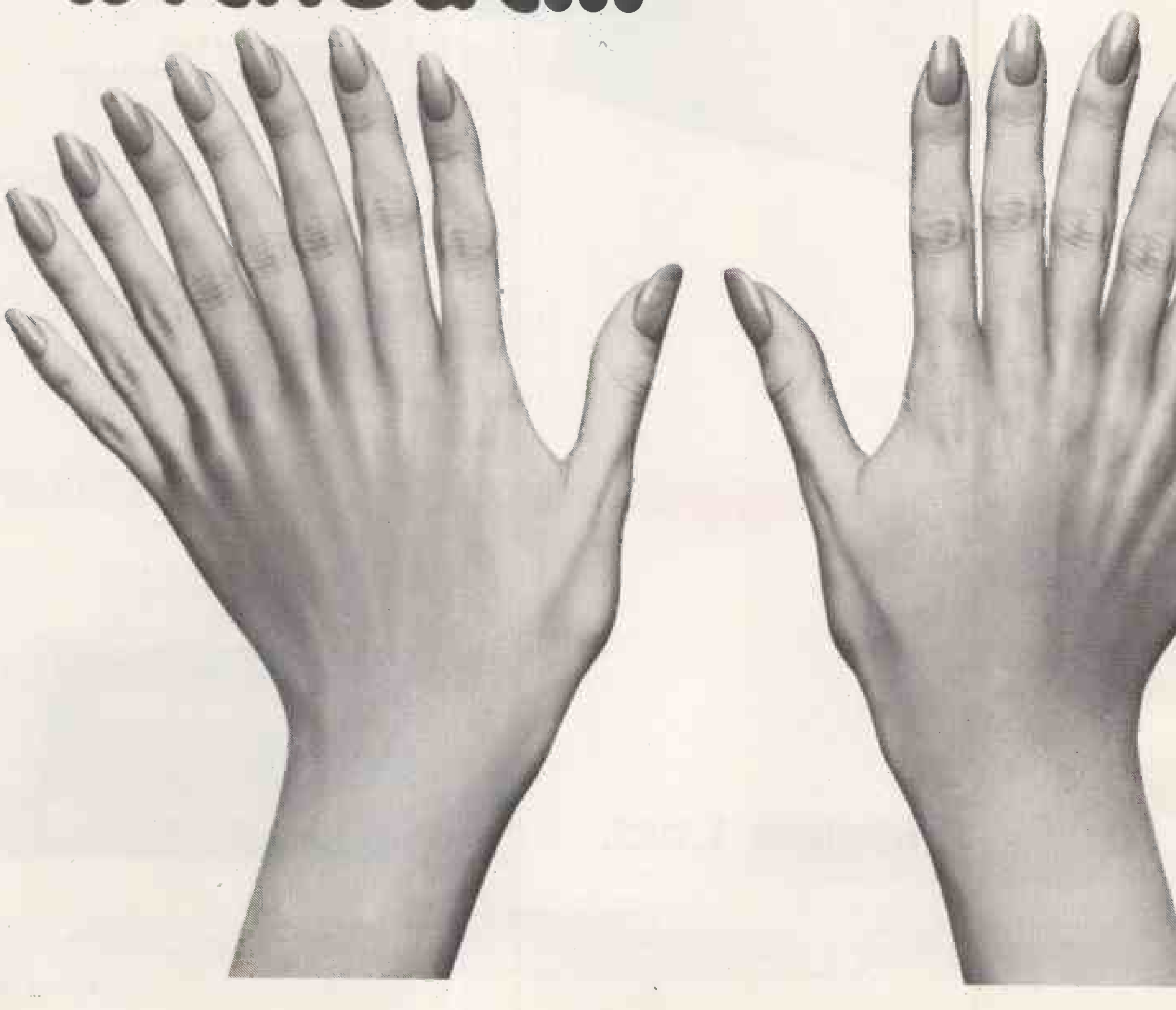

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FAIR REPAIR

Thom read the screen almost as quickly as it filled.

"It's worse than we suspected", he sighed, turning away deep in thought.

"Shall I call up the long-stay site recommendations, Sir"? asked Ronald.

"What? Yes, you'd better", replied Thom. Sitting down gently, he paused, then slowly repeated his advice: "Yes, you better had, Ron".

Master-Captain Thom silently studied his thumb nails, elbows on knees, while his first mate keyed in call codes at the terminal. As the main screen continued to display its gloomy report Thom remained lost in thought, Ronald in numerical combinations.

Eventually the first mate completed his library search; he entered the right code and sat back. Somewhere, a long way from the bridge a warning siren wailed. During the few seconds the page took to arrive Thom roused himself and glanced surreptitiously at the main screen. Perhaps he had hoped for a revision notice, but the original message lingered, terse and authoritative:

COLLISION REPORT:
IMMEDIATE SYNOPSIS

Damage by meteorbody most severe:
powersections 4, 5, 7 inoperable
timeshift core fractured
Regeneration estimate: 500 hours

WARNING DO NOT ATTEMPT ANY
TRAVEL OTHER THAN FREE FLIGHT
THIS IS A CLASS ONE ORDER

"Whatever 'meteorbody' means", muttered Thom. "If the damn thing doesn't know what hit us, it should say so".

Underneath the large print, the text offered a selection of button numbers to press for various technical details already being carefully studied by the engineers elsewhere on board the ship. Here on the bridge the nuts and bolts of the situation were of secondary interest — Thom and his immediate companions had other, more pressing problems.

Outside, ahead of the craft, loomed the planet they had crossed the galaxy sector to study. This obscure but fascinating little world had been under regular observation for several decades. Thom's own ship had been three times before.

They had been positioning in readiness for their six months watch — the previous ship had left for home a couple of weeks earlier — when entirely without warning a large object passed clean through the works. Why the detector systems had failed to discover the approach of such a massive boulder was worrying enough, what the impact meant to the vessel at the approach stage, was something else.

Power had been lost immediately but the collision had done nothing to check their speed. In space there is nothing to stop a craft once it is moving — unless of course it hits a planet like the one Thom and his party were heading straight for. With no energy for reverse thrust, an entry into a controlled orbit was out of the question. If the emergency landing procedure failed, the ship would hit the surface with enough velocity to be shattered without trace.

Even with a successful touchdown, Thom would still be in trouble. A supreme command stated that no survey craft must make contact with the inhabitants of this world. Simply landing was enough to earn a humiliating recall. Other teams had occasionally made emergency landings, but never for more than a few hours.

In any case, most had already been in controlled orbit so they were able to

by Brian Williams

choose a suitably remote region for their repairs. Thom would have to sit tight on a more or less randomly-chosen spot for three weeks without attracting attention.

On top of that there was no chance of assistance. The regulations were most specific. The natives — the official term was "indigenes" — must not get their hands on an intact craft. Survey vessels were lightly armed, and the beings who inhabited this planet, though otherwise technologically backward, excelled beyond reason in the manufacture of all manner of weapons.

"That's all we need", moaned Thom. The screen, instead of displaying the expected library page about landing zones, simply stated:

Emergency landing sites
now determined by Omnimum.

Omnimum, the latest in self-educating control systems, quietly taught itself all the elements of the operation, management and cost-effectiveness of the craft. As it mastered each discipline it assumed control. Captaincy was becoming a redundant profession.

Angrily, Thom growled: "Now we have to sit here while that calculator decides where to dump us".

"Message from Base, Sir", Thom was interrupted by Hass, the signals officer. Neither Thom nor Ronald had seen him enter; both started. The Captain grabbed the pad and, for Ronald's benefit, read, "Report received. Enforced landing considered Fair Repair. Good luck".

Handing the message back to Hass, Thom announced: "That's the first piece of good news today. Thank you, Hass".

Fair Repair meant the crew were in no way to blame for the accident or the consequential down-time of the craft. Omnimum must have sent the report automatically; perhaps its silicon heart was in the right place after all, encouraging all the right responses from a habitually dour base.

"Ready when you are, Sir", prompted Ronald.

"Right", came the reply. "Let's see what Man plus Omnimum can make of this lot."

Despite only having the landing trimmers to work with, Thom's crew made a fine touch-down. They approached on the planet's day side so that their frictional glow would not be noticed, then performed a tedious routine of up-and-down spiralling until atmospheric drag killed their speed without frying them first, before gliding in to a perfect landing.

Omnimum had dictated the co-ordinates but was secretive about the terrain. The latter stages of descent had channelled them into the night half of the planet, so the external scanners remained dark and silent.

Thom rubbed his hands over his eyes. "What now"?

"We'll have to see what the morning brings", suggested Ronald unenthusiastically.

This world they were on — it had never been given a name, just a catalogue number — was the last place any of them wanted to be. The temperature, the gravity and the inhabitants were all so harsh

On the third day three natives arrived — Thom warned of trouble.

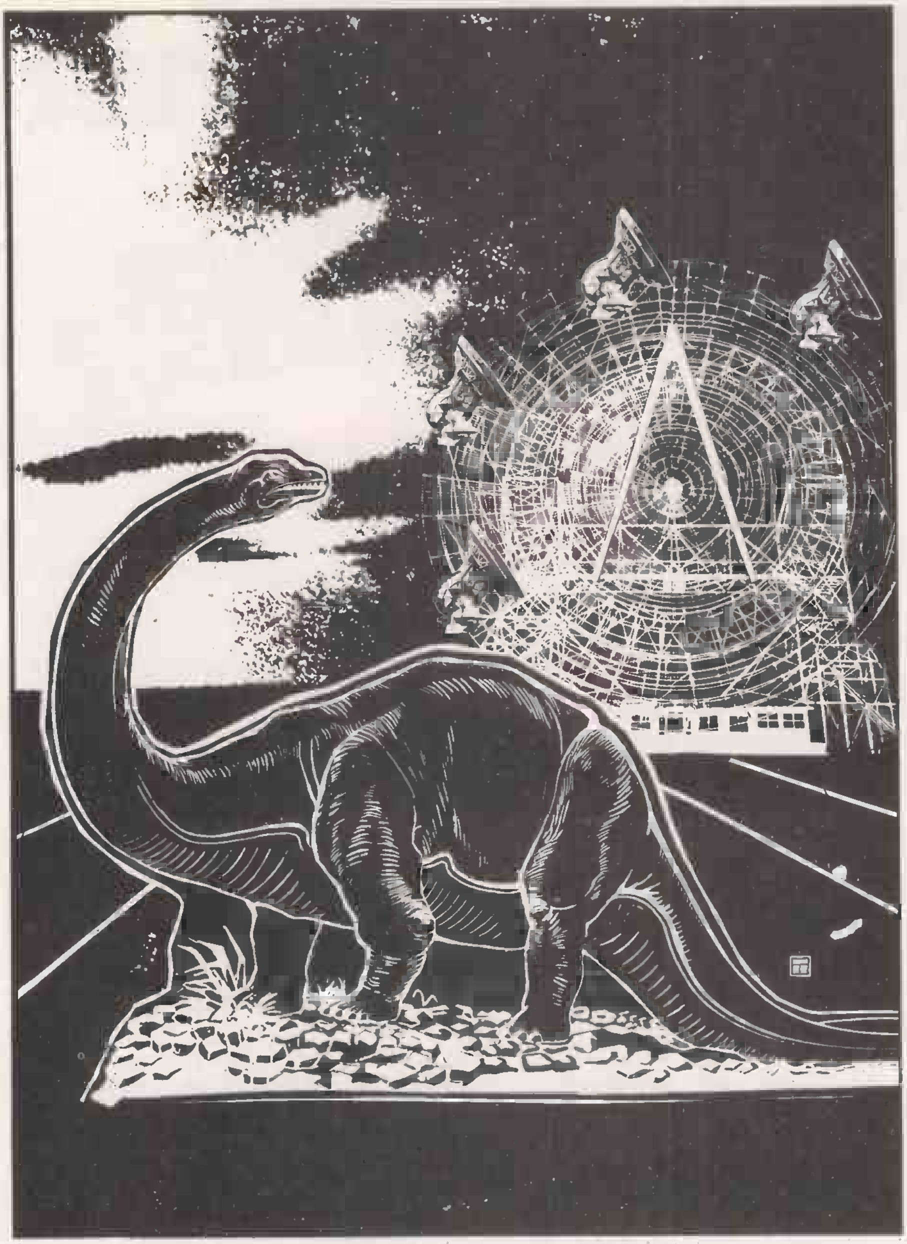
and unpleasant. Ideal for a prison colony, maybe, but appalling as a spacecraft repair shop.

"At least we have technology on our side", the first mate offered, "they didn't see us come".

"No", said Thom, "but they still frighten me".

A couple of days had passed and automatic regeneration was under way. Internal systems had to be kept low, or switched off, making the ship cold and gloomy. Already a little boredom was evident: the survey team had come to observe the weather systems, the moving parts of this world, but the surface seemed devoid of interest.

No-one could decide on the function of



their immediate environment. Next to them stood a series of box-like structures made from some plants that grew on the planet. These huts looked too frail for habitation and, besides, nothing had stirred since the ship's arrival.

A high, metal frame looked like a cumbersome large aerial. Other equally strange constructions were on the site, the most curious being a rough imitation of a large land animal known to have roamed the area some millions of years previously.

The crew were divided on the interpretation of these artefacts. Some thought the compound was a religious temple, others a museum. None of the buildings or devices had any obvious use and the place had a fatuous air throughout. Presumably Omnimum, having selected the spot, had a few ideas, but it was not going to share its knowledge.

No-one wanted to leave the craft. They were ill-equipped for venturing into the poisonous gases, and the exterior temperature was becoming unbelievably low. Besides, previous surveys had attended to all the surface samples. Nevertheless, plenty of activity was going on elsewhere, even close by, evidenced by the microwave communications rattling their antennae.

On the third day three natives arrived. Thom warned of trouble. How could Nature have developed such creatures, with their long, lanky bodies not suited to anything obvious? Probably the best she could do in this alien world. Still, they were relatively successful.

One of the figures stopped and pointed at the craft. The others looked briefly at it, then all three walked on towards the aerial. From there they ambled to the front of the large land-animal facsimile, which interested them especially. All in all, the three spent almost an hour and a half inspecting everything on the site. They then left, passing by the space craft without a glance. And that was all.

After 19 days the work was complete. All parts fabricated, fashioned and fitted by the vessel's internal repair programs. Not before time. Most of the crew felt terminally stiff either through cold or boredom.

Apart from a little excitement a few days previously nothing whatsoever had happened to break the monotony. Even that event was hardly stimulating, little more than a repeat of the earlier visit by the same three indigenes. This time, one of the awkward creatures had come over and tapped the hull, looked disappointed and rejoined the others who were attending to the metal frame.

Warm-up, systems check, and take-off, went without a hitch. If anyone saw them go, the crew never knew. Very swiftly the conditions aboard the ship returned to normal; just a few miles out into space the involuntary groundstay was already history. Omnimum had delivered the goods after all.

The men had disposed of that dreadful bodged-up spaceship.

The Bentley whispered to a halt. Carling looked up as the chauffeur opened his door. Good. The new sign was in position over the gates. In the weak April sunshine the dapper businessman read:

CARLING'S FUN FAIR.

He rather liked his latest property acquisition. A little run down perhaps, and seasonably bleak. But in a couple of months the crowds would start building up in the small seaside town, bringing life and cash flow to his amusement park on the outskirts.

Already his men were in action: the Big Wheel was being prepared for an insurance inspection; the huge Brontosaurus was receiving a new skin of paint; all the stalls were having a smarten-up; and he noticed the men had disposed of that dreadful, bodged-up spaceship to make room for the car-park extension the local authorities had insisted on. Not a bad investment. The renovation work was simply fair repair, you might say.

Funny thing, though, the spaceship. It had not been on the inventory or the old insurance schedule. It had had a curious bearing, too. Massive, yet small at the same time. Still, it had sounded perfectly hollow, just like the fibre-glass dinosaur.

Anyhow it had looked like something out of a third-rate science-fiction movie, and nobody in these space-enlightened days would have been interested in it.

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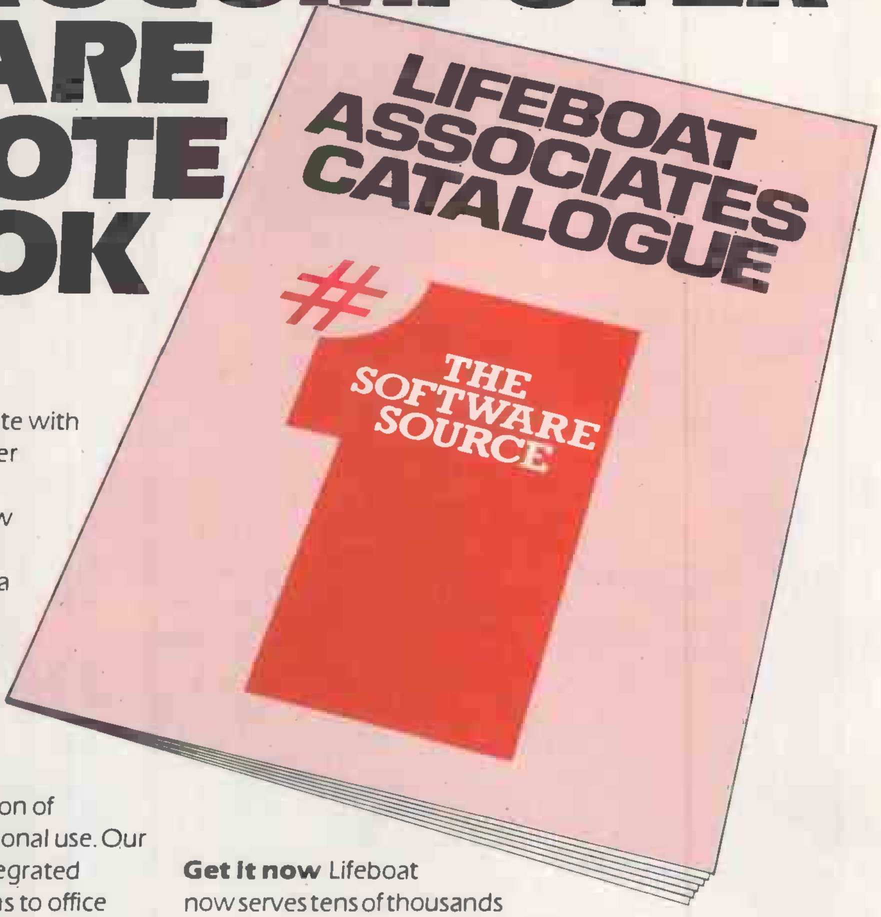

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● Circle No. 169

Micros can help the handicapped

Dr Ranjit Gill's team at Brighton Polytechnic is bringing together the magic of cartoon and computers for the handicapped. Martin Hayman looks at this application of "convivial computing".

ONE DAY SOON the majority of microprocessor-controlled devices will be operated by voice. That, at least, was the prediction of the late Chris Evans in his book *The Mighty Micro*, back in 1979. Aspiring computer professionals who have only lately conquered the QWERTY keyboard need not worry, for the keyboard is likely to be pre-eminent for many years to come in professional data-processing applications. Social, domestic and pleasure activities will be taken over by voice control and its corollary, speech synthesis, as part of the great shift towards what artificial-intelligence guru Terry Winograd calls "convivial computing".

Mimicking humans

The convivial computer will perform like a human and participate in human activities through appropriate interfaces. Spoken natural-language input will really bring the microprocessor-operated device, be it toy, tool or education aid, into the widest possible circulation.

Voice control and natural-language input still demand a great deal of work, with little prospect of short-term financial return. At present they are more likely to be developed by those who feel there is an urgent human need to deploy computers for social benefit or domestic and pleasure activities, rather than for trade.

Ranjit Gill leads a team dedicated to making computing convivial at Brighton Polytechnic's department of Computing and Cybernetics. Gill and six final-year students of various nationalities have created the Computer-Aided Arts and Animation Theatre, CAAAT. They are trying to bring the magic of cartoon and computer together for the handicapped, who are excluded by their disabilities from a wide range of human activities. Gill's project "aims to make available to the handicapped those facilities which will enable them not only to control their environment better, but also find areas of expression and communication with others in spite of their limitations of speech or personal control".

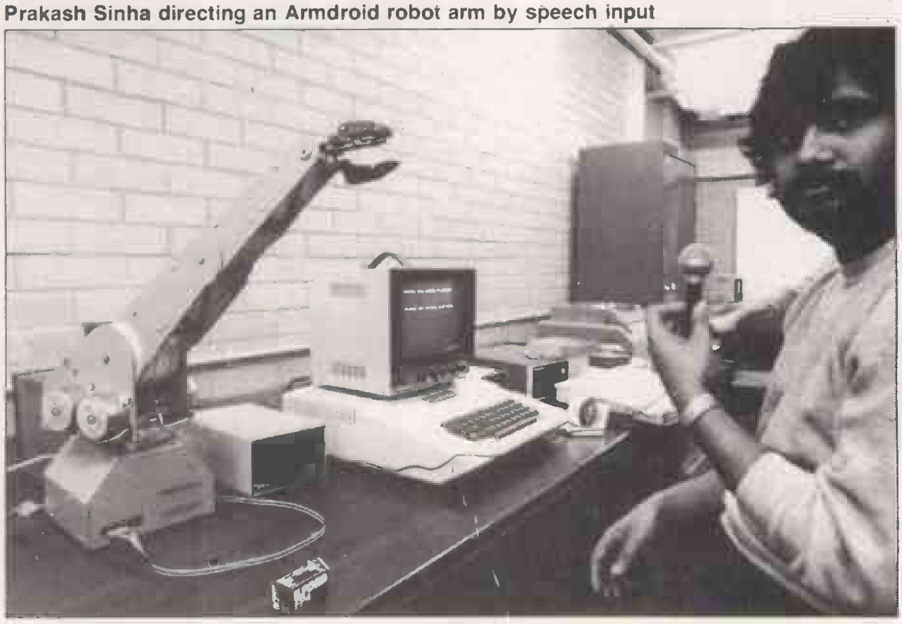
Five modules

The project is divided into five modules. Computer-Aided Animation allows the user to construct cartoon shapes from stored cartoon components, characteristically bits of the body such as the head, arms and trunk; to store the shapes; and to use commands such as "swim" or "run" to develop and store a story line. Commands can be made by voice or keyboard input and in cases of severe disability or retardation this helps to improve the user's hand-eye coordination and control of body movement. The speech-based Picture Editing module is an extension of the animation module which permits the storyline itself to be edited, stored and played back.

On a recent visit to Brighton I saw one story line, "Superman", in action. In practice it works well, and is very easy to understand. A simple figure is called out of memory and those shapes conjoined by the use of cursor commands — up, down, left and right arrows. This is handled by Sinta Software's Shape Manager program, which was reviewed in the March *Practical Computing*. A shape,

(continued on next page)

Prakash Sinha directing an Armdroid robot arm by speech input



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which may be a simple line or curve or as complex as, say, a gorgon's head, is drawn freehand and laid over the screen as a transparent mask. The micro recognises and "memorises" the shape, which can subsequently be called out and moved around the screen.

Alternatively speech input can be used. The micro must first be trained to accept the defined list of commands from the user's voice. This is specially important for people with severe speech handicaps who may not be able to articulate the commands in standard English pronunication. Once trained, the micro will recognize semi-articulate sounds as valid commands. If the user makes a mess of Superman, by directing the arms off the edge of the screen for example, the software sends a personalized message out through the speech box: "No Martin, you can't go that way".

Getting acquainted

It must be said that the Microspeech 2 speech synthesiser sounds awful, though it is due to be replaced shortly with the more effective Wordtex. The prompts, and labels for the shapes under manipulation, are also displayed in big characters on the screen. This is intended to accustom the user or pupil to instructions, and to aid the teacher in familiarising the pupil with more conventional methods of instruction. To this extent, it is an improved communication device for those who have to instruct pupils with severe learning problems.

Gill started in mid-1981 and the work soon expanded to take up his summer holiday, weekends and evenings, as well as the attention of his two children, who created some of the first "designs" for figures used on the screen. Gill extended the design exercise into local schools, where he ran a competition to generate graphical material expressing the experience of the disabled.

Gill, who has lectured at Brighton for 10 years, compares his interest in computers for the disabled to his involvement with language schemes for Asians, who are also disadvantaged in English society. They may not be able to speak English well, or at all, and they are culturally isolated from English life. The problem is not merely one of teaching English but of conveying some grasp of the cultural meaning of the language. Any human language enshrines the concepts of its own culture, unlike a computer language. One of the "convivial" uses which Gill foresees for the computer is to act as a pupil/teacher interface to improve the methods by which culture is "taught" along with language.

Gill feels that research in computing is too narrowly directed either to specific industrial ends or to academic research, with too little emphasis on the middle ground of social and educational applications. He is struck specially by the dry linearity of conventional teaching, both for adults and children. He wants to see much greater creativity by using graphics, sound, speech and text together to make that communication a more creative, interactive process.

The disadvantaged find it difficult to express their experience of the world, though that experience may in itself be highly developed. This new tool, the micro, should help them to communicate their experiences to those in the "outside world", resulting in a better and fuller exchange of experiences and, Gill hopes, better mutual understanding. So the micro is here conceived of as an interactive teaching and learning tool capable of improving human communications via progressively more sophisticated interfaces. To complement the keyboard, it will use speech and visual inputs, even touch in the form of a screen light-pen and digitising tablet.

I saw some students developing the speech program to instruct a robot arm, and invited Prakash Sinha to demonstrate the arm. The task set was to pick up a small carton under speech instruction. First he showed me how the Apple is trained to recognise the menu of commands from a particular voice — obviously the speech box recognizes sounds rather than identifying words.

Consistent pronunciation

Once the arm is trained to recognise the particular voice vocabulary, the user can go ahead and manipulate the arm by issuing commands, either for half- or full-step operation, software-switchable at the start of the operation, to each part of the arm he wishes to move. Occasionally the screen fails to respond, but so long as you pronounce each command with more or less the same stress and intonation as used when training the vocabulary, the computer issues signals to the stepper-motor driven arm quite reliably. The arm itself, described as Armdroid and built by Colne Robotics, was unfortunately suffering from drive-belt slippage at the shoulder.

Module 3 is Speech/Sound-Based Text Processing, allowing disabled users to use their own sound or speech to generate text from stored words, phrases or text, to write it to screen or printer, and to edit, insert or delete in the normal way. The advantages of being able to write and draw are obvious for the most severely disabled, who may lack articulate speech as well as muscular control.

International prospects

Module 4 may hoist Gill on to the international circuit. It uses inference rules for natural language processing, visual literacy, speech understanding; to develop an intelligent teaching, monitoring and assessment system on a microcomputer. This work should lead to a new direction for computer-aided learning and teaching. Gill hopes to humanise AI techniques and popularise them for human communications. The example of the robot arm vocabulary is useful here: at primary-school level you can do a great deal with a vocabulary of 64 words.

A future expert system for learning might contain various modules with rules of teaching, learning and personal communication, together with a module of rules for monitoring and assessing the pupil's progress. Specific techniques might include those of the linguist, the artist and the speech therapist.

American Express has endowed Gill with sufficient funds to buy the two Apples used by the unit but he now hopes to get backing from a big trans-governmental agency such as UNESCO. On that basis he believes that his teaching system could be implemented as a speech-training scheme for people in the Third World, to convey language in its cultural envelope.

Putting life into sketches

Micro technology is freeing cartoonists of much of the drudgery of their work, allowing more time for creative endeavours. Lodge/Cheesman's computer-drawn animation for KP Outerspacers (left) has become a familiar sight on cinema and TV screens. John Lewell tried out some of the latest equipment in a computer-based animation workshop led by Co Hoedeman (above), the animator who won an Oscar for *Sandcastle*.

DEDICATED FILM-GOERS, still reeling from over-exposure to film at the festivals of Deauville and Venice, converged on Cambridge last autumn for the biannual Cambridge Animation Festival. For six days, professional film-makers, students and animation buffs attended screenings of nearly 200 animated films.

The main themes of the festival were jazz and computers. If this seems like an unlikely combination, they were at least linked very cleverly in a title sequence made specially for the event. Though a retrospective of historical films with jazz soundtracks was probably the more entertaining of the themes, the full day of discussions, lectures, product demonstrations and screenings of computer imagery seemed more relevant to the contemporary animation scene.

Certainly, computers attracted plenty of attention, even from animators who were steeped in the more traditional skills of their medium. Antoinette Moses, the director of the Festival, commented: "We have brought together the world of Cambridge scientists and the world of London film-makers. I think we have broken down some barriers this time".

This was an accurate, if perhaps an over-modest observation. Many people at the event had come from overseas, as indeed had some of the products on display. Speakers on computer graphics included Andre Martin of the Institut National de l'Audiovisuel in Paris. He clearly spelled out some of the implications of the new technology, saying: "If animators do not appreciate the new techniques they will find themselves being replaced by those who do".

It was interesting, therefore, to hear the comments of the animators themselves, after they had had a chance of a hands-on session with some computer-based equipment. A workshop was formed, under the guidance of Co Hoedeman, the Oscar-winning director of *Sandcastle*, and visiting animators were able to see their off-the-cuff pencil sketches brought to life with the NAC Advanced Animation and Graphics System.

Vigorous selling

NAC is a Japanese company which specialises in motion-picture instrumentation. Its home market for equipment must be substantial, bearing in mind the healthy state of the Japanese animation industry. None the less, NAC's system is being marketed with some vigour in the United States, and in the U.K. is distributed by International Instrumentation Marketing, based in Thame, Oxfordshire.

The NAC system is what it claims to be: a complete system. Only the quick-action recorder was prominent at Cambridge, but the system also includes a video action tracer, a film action tracer, a video animation stand and a video animation recorder. The system claims to add up to a major additional tool for the animator.

The quick-action recorder is designed to replace the existing methods of making a pencil test. A test from the original sketches by conventional means can be nearly as time-consuming as shooting the finished cel animation. To see if an animated sequence will work, the pencil sketches are filmed, often several times over, with different timings in each version. A combination of computer and video technology is ideally suited to making this task easier. Not only do you get instant replay, you can also adjust the timings until the optimum set is discovered. Drawings are stored frame by frame in a computer memory, allowing access for editing, replay, or repeating selected sequences.

Apart from the video camera and table, there are four main components of the quick-action recorder: a rack-mounted CPU, a viewing monitor, a menu monitor for showing modes, commands and exposure information, and a small, neatly-designed keyboard for entering instructions. The recorder can be connected to a VTR for storing sequences which are too long to be held in memory.

Several memory options are available, including those for storing 30, 60, 120 and 240 line drawings. Playback speed can be preset or varied at any rate between three and 60 frames per second. A picture has to be entered into the memory only once, because the repeat function can hold the sketch for as many frames as are required.

Operating the quick-action recorder is surprisingly simple and flexible. It is certainly more efficient than using conventional photography, and it does not make any of the traditional skills redundant. Able to interchange frames, to erase frames, or to put others through a variety of loop sequences, this machine makes a useful addition to the animation studio.

Of the other products in the NAC range, the video and film-action tracers are used for rotoscoping — that is, tracing live action into outline drawings or combining live action with animation. If Ralph Bakshi's *American Pop* has not permanently killed the desire to rotoscope, there may be a market for these systems.

Both tracers, together with the video animation stand are designed for the professional animator, while the video animation recorder is a more down-market machine. It is VHS cassette-based, with a remote-control panel for operating in a frame-by-frame mode. Of this product the NAC brochure says: "Anybody can make video catalogue. Feel more free to try new idea and feel more easy to venturing." Though this may sound like a dubious invitation to downtown Tokyo, the NAC equipment deserves to be taken seriously.

Suiting every pocket

Another system on display at Cambridge was an Apple-based rostrum-control system from Animation Equipment Engineering. This company offers a wide range of studio equipment — from their Grand Stand rostrum, priced at £9,320, all the way down to filters, peg-bars, dimmers and switches.

The Apple system, called Caro — for computer-aided rostrum operation — is designed to control the complex rostrum movements which are necessary in full-scale animation. With the addition of stepper-motor drives and interfaces, the computer will handle the calculations for pans, zooms, tracks and rotations. Other drives are available for focus, fades and dissolves. The package comes with dual floppy discs and a monitor which shows relevant information: camera position, frame numbers and the exact positions of each axis.

Of the speakers at the Cambridge mini-teach-in on computer animation, only those who had seen the recent computer films at the Siggraph convention were guilty of holding out big promises for the future. By contrast, Neil Wiseman from the Cambridge University Computer Laboratory, noted ironically: "Interactive computing is such fun we often like to use it even if it makes things worse". Tom Sancha, of Cambridge Interactive Systems, an expert on computer-aided design, gave a clear explanation of the techniques used in his branch of the medium, but said: "Most computer-generated pictures have a Hockneyesque character". I am not sure where that leaves computer graphics — or, for that matter, David Hockney — but I am sure

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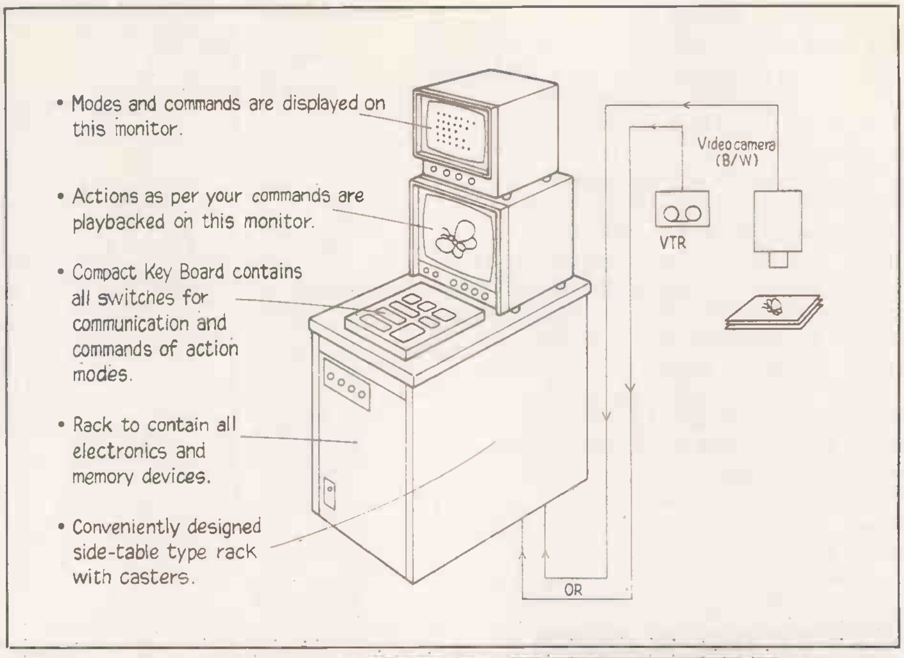
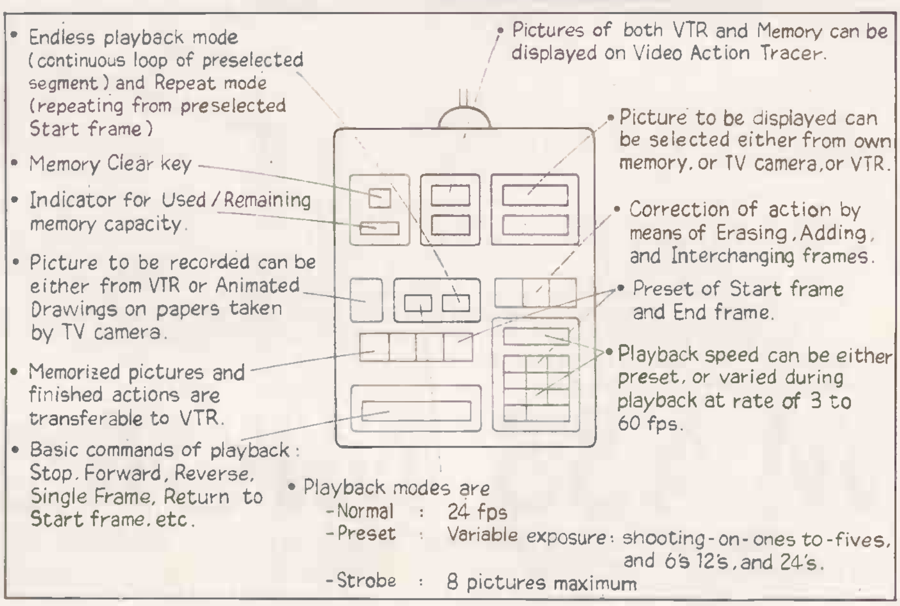


The NAC quick-action recorder is intended to replace time-consuming conventional pencil tests. An animator (right) can call up frames from memory and vary the order of shots or the "perceived speed" of the film at will. Using conventional photographic techniques this could take hours. The whole unit consists of a rack-mounted CPU, viewing monitor, menu monitor and keyboard, linked as shown (above). The keyboard (below) allows full access to the electronics which are tucked away in a side-table style rack. A wealthy animator could also buy NAC's video action tracer, video animation stand and video animation recorder which are fully compatible. These NAC machines are intended to speed existing methods of animation rather than create "computer cartoons".



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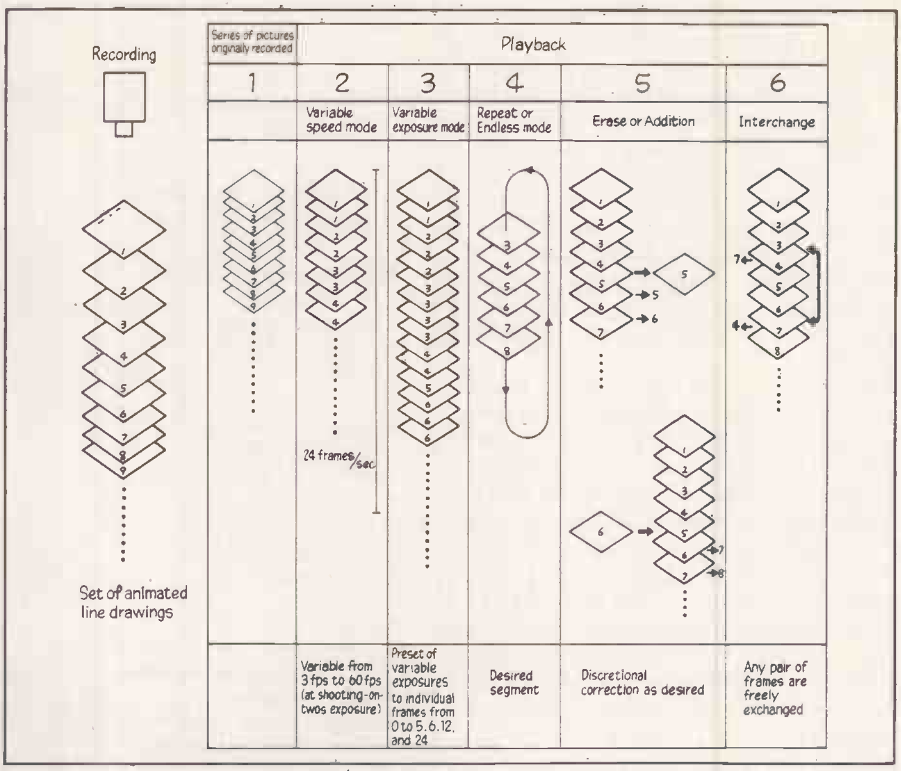
that most of the audience were unaware that the three-dimensional pictures which were used to illustrate the talk were in fact merely stills from fully-animated sequences.

The workshop session produced an interesting, if somewhat incoherent, film. No doubt, animators learned some new tricks, but neither computer-controlled rostrums nor systems for animating pencil sketches are truly representative of the major changes which will be taking place in the animation industry. Nevertheless systems such as these help to introduce some of the basic principles of the computer. More exciting are the paint systems which are currently under development by Logica and Quantel, and the work being done on three-dimensional computer imagery.

A warning to hopeful manufacturers trying to cash in at the early stages of development came from Co Hoedeman: "Today we have this, tomorrow we have something else. When I am ready, as an artist, to use a computer for creating the image — or on some other part of making a film — there will be something quite different available. Computer animation is just a child growing up".

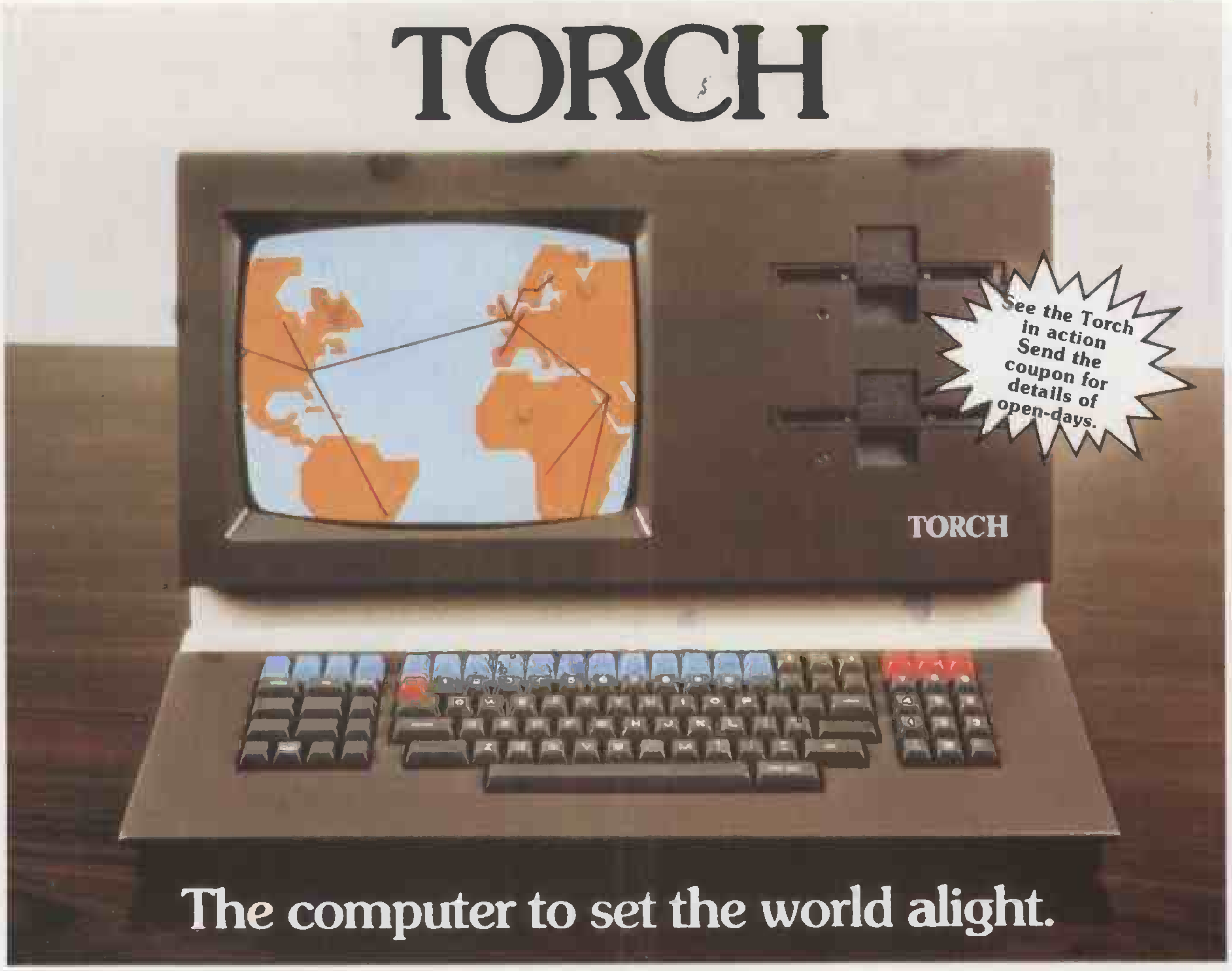
Animators, despite their sometimes notorious sense of humour, tend to be very serious and cautious about their work. After all, it takes them a long time



Functions of the quick-action recorder.

to become fully competent in their art.

The use of computers in animation will find general acceptance only when manufacturers can demonstrate real commercial or creative advantages in using their products. NAC and AEE are quite convincing at a very modest level. It now remains to be seen whether more powerful packages can be marketed successfully.



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● Circle No. 173

Making it fun to learn tables

When his youngest son came home and asked to be tested on his multiplication tables John Craig seized the opportunity to write a clear and concise program for his Pet.

AFTER READING Nick Hampshire's article on Pet graphics in *Practical Computing*, June and July 1981, I decided to use some of his subroutines in place of my normal methods. The first opportunity came when my youngest son started to learn multiplication tables at school, and requested a program that would test his knowledge of them.

The program asks first for the highest number of tables to be tested on, then gives the option of studying the tables before answering any questions. The question is displayed, and if the correct answer is entered it is "ticked" and the next question is displayed. If the answer is wrong, the tables are displayed with the correct answers highlighted in reverse video; after a pause the question is then displayed again. To finish the session, a * is entered as the answer and the pupil's score is displayed.

I found the most convenient way of using the graphic subroutine was to use variables for the start-line number, column number and other parameters required by the subroutine and then assign values to the variables before calling up the subroutine.

The program was written on a 3000 series Pet but if you have converted Nick Hampshire's program to run on your Pet this program will also run satisfactorily.

Screen graphics

The screen graphics program given in Nick Hampshire's articles is first loaded and run. There is a mistake in Hampshire's version: line 310 of the Basic program should be amended to read

DATA 48, 98, 48, 8A, 48, 20, 00, 74, A4, 58, A5, 00.

The pupil's name is printed by line 1760. If the program is to be used with several pupils, the pupil's name can be left out or an additional input added by adding Gosub 2050 in line 500, between Gosub 1970 and Goto 760, then substituting line 2160 as line 1760.

My normal method of placing the cursor at a screen location is to key a screen home, followed by the required number of cursor-down and cursor-right operations. To save space and for ease of use during programming, in the initialisation part of the program I would have

SP$ = 39 blanks
SD$ = 24 cursor-downs
SU$ = 24 cursor-ups
SR$ = 39 cursor-rights

The cursor-up was sometimes used after printing error messages or prompts

(continued on next page)

```
100 REM ***********************************
110 REM ***   MULTIPLICATION TABLES    ***
120 REM *** COPYWRIGHT JOHN CRAIG 1981 ***
130 REM ***********************************
140 REM
150 REM            *** LIST OF VARIABLES ***
160 REM
170 REM             A3$=KEYBOARD INPUT
180 REM              A3=VALUE OF KEYBOARD INPUT
190 REM          EM$(I)=ERROR MESSAGE
200 REM              A2=TIMER DELAY
210 REM
220 REM                Z1=FLAG FOR WRONG ANSWER
230 REM                Z3=ERROR MESSAGE NUMBER
240 REM                Z5=CHECK IF QUESTION REQUIRES DISPLAYING AGAIN
250 REM                Z6=ERROR FLAG FOR KEYBOARD INPUT
260 REM                Z7=FLAG IF ERROR MESSAGE WAS DISPLAYED
270 REM
280 REM                  D=TABLES NUMBER COUNTER
290 REM                  E=TABLES POSITION COUNTER
300 REM                  Q=QUESTION NUMBER
310 REM                  T=PUPIL'S ANSWER TO QUESTION
320 REM                  W=CORRECT ANSWER TO QUESTION
330 REM                 F$=STRING EQUIVALENT OF W
340 REM                  Y=HIGHEST TABLES NUMBER TO BE TESTED ON
350 REM                  V=FIRST NUMBER GENERATED
360 REM                  Z=SECOND NUMBER GENERATED
370 REM                  H1=WRONG ANSWER COUNTER
380 REM                  H2=CORRECT ANSWER COUNTER
390 REM
400 REM ***********************************************************
410 REM *** A1 :   VARIBLES USED IN SCREEN GRAPHICS SUBROUTINES ***
420 REM *** B1 :    THE SUBROUTINES ARE FROM "PET GRAPHICS"     ***
430 REM *** C1 :              BY NICK HAMPSHIRE                 ***
440 REM *** D1 :            PUBLISHED BY COMPUTABITS            ***
450 REM *** E1 :                                                ***
460 REM ***********************************************************
```

(continued on next page)

(continued from previous page)

at the bottom of the screen, and the SP$ used to blank out the error message or prompt. It is then a simple matter to place the cursor at any position by

PRINT '(home)'; LEFT $ (SD$, 10); LEFT $ (SR$, 20)

which will place the cursor 10 lines down and 20 columns across.

For simple single movement of the cursor, I still prefer this method, but in the listing of the multiplication program I have only used Nick Hampshire's routines. The program starts at line 490 with Poke 59468, 14 which changes the character set to lower case. The Gosub 1970 at line 500 initialises the error messages; I hold the error messages in the array EM$ (I) so they can be called up as required by printing EM$ (I).

I have located the data statement at the end of the program as it is only read once. The Goto 760 skips past the Keyboard Input, Time Delay and Hold subroutines which are part of my standard repertoire and are stored at the start of the program. On the Gosub command, the Pet looks from the start of the program until it finds the required Gosub.

I could also have placed the screen graphic routines at the start of the program after they were developed. Line 770 clears the screen with Print "CLR" then sets the variable A1 with 8 and B1 with 0.

The Gosub 1540 is the cursor-place routine which will place the cursor at line 8 column 0 ready to print the instruction text, lines 780 to 840. The ";" at the end of line 840 is used to keep the cursor on the end of the printed text. If the ";" is omitted, the cursor will fall to the line below. At line 850, Gosub 540 is used instead of Input A3$; this subroutine treats the keyboard as an input device, the device number of the keyboard is 0. Therefore OPEN 1,0
opens the keyboard for an input, after the input the keyboard is closed, with

CLOSE 1,0.

This routine prevents the program ending prematurely if Return is depressed without any data being entered.

Input check

Gosub 590 then checks that the input is numeric by assigning to A3 the Val of A3$. If A3 is 0 then A3$ is not numeric, therefore Z3 is set to 3, and A2 to 90. The Gosub 630 at line 600 displays error message 3 for time A2. On returning to line 600 Z6 the keyboard-input error flag is set to 1. Then on returning to line 910, if Z6 is 0 and A3 less than 11, control is transferred to line 910, otherwise the input is blanked out by line 870 and control is transferred back to line 850 by the Goto at line 880 after cancelling the error flag Z6. Lines 900 to 960 follow the same pattern of events for the option of studying the tables.

Lines 980 to 1040 form the loop that generates the question. Line 990 indexes the question number counted Q. Lines 1000 and 1010 generate the numbers to be multiplied together, and line 1020 sets W with the correct answer. Line 1030 checks whether the question is new or a reprint of a wrongly answered question. It enters the Display Question routine at 1410 to display the title block by Gosub 1750 and prints

EM$ (1)

If you are finished enter "*" at the bottom of the screen. Alternatively it enters the routine at 1430 to display the question.

Line 1070 is the answer input, with a check that it is numeric. If the input is not numeric, 1090 erases the input and returns the cursor to the correct position to wait for a numeric input, when Goto

(continued from previous page)

```
470 REM
480 REM
490 POKE59468,14:REM POKE59468,12 RETURNS UPPER CASE
500 GOSUB1970:GOTO760
510 REM
520 REM
530 REM              *** SUBROUTINES ***
540 REM KEYBOARD INPUT
550 OPEN1,0:INPUT#1,A3$:CLOSE1
560 IFA3$="*"THENGOTO1800
570 RETURN
580 REM
590 REM CHECK IF KEYBOARD INPUT NUMERIC
600 A3=VAL(A3$):IFA3=0THENZ3=3:A2=90:GOSUB630:Z6=1
610 RETURN
620 REM
630 REM DISPLAY ERROR MESSAGE FOR TIME A2
640 A1=23:B1=0:GOSUB1540
650 PRINTEM$(Z3)
660 T6=TI+A2
670 IFTI<T6THEN670
680 IFZ7=0THENA1=23:B1=0:C1=39:D1=32:GOSUB1580
690 RETURN
700 REM
710 REM WAIT FOR KEY DEPRESSION
720 GETA3$:IFA3$=""THEN710
730 RETURN
740 REM
750 REM
760 REM DISPLAY INSTRUCTION TEXT
770 PRINT"⅃":A1=8:B1=0:GOSUB1540
780 PRINT"IHIS PROGRAM WILL TEST YOUR KNOWLEDGE "
790 PRINT
800 PRINT"OF MULTIPLICATION TABLES."
810 PRINT
820 PRINT"¬NTER THE HIGHEST NUMBER OF TABLES"
830 PRINT
840 PRINT"YOU WISH TO BE JESTED ON ";
850 GOSUB540:GOSUB590:IFZ6=0ANDA3<11THEN910
860 IFZ6=0THENZ3=2:A2=90:GOSUB630
870 A1=14:B1=24:C1=3:D1=32:GOSUB1580:A1=14:B1=25:GOSUB1540
880 Z6=0:GOTO850
890 REM
900 REM DISPLAY TABLES QUESTION
910 Y=A3:PRINT"⅃"
920 A1=10:B1=0:GOSUB1540:PRINT"¬O YOU WISH TO STUDY THE TABLES FIRST "
930 PRINT
940 PRINT"  ˥LEASE ENTER  I OR / ";:GOSUB540
950 IFA3$="Y"THENGOSUB1220:A1=23:B1=0:GOSUB1540:PRINTEM$(6):GOSUB710:GOTO980
960 IFA3$<>"N"THENZ3=7:A2=90:GOSUB630:A1=12:B1=21:C1=3:D1=32:GOSUB1580:GOTO920
970 REM
980 REM LOOP TO GENERATE QUESTIONS
990 Q=Q+1
1000 V=INT(Y*RND(1)+1)
1010 Z=INT(10*RND(1)+1)
1020 W=V*Z
1030 IFZ5=1THENGOSUB1430:GOTO1060
1040 GOSUB1410
1050 REM
1060 REM INPUT ANSWER
1070 GOSUB540:GOSUB590
1080 IFZ6<>1THEN1100
1090 Z6=0;A1=12:B1=24:C1=4:D1=32:GOSUB1580:A1=12:B1=25:GOSUB1540:GOTO1060
1100 T=A3
1110 IFT<>WTHENGOSUB1480:GOTO1060
1120 A1=12:B1=28:GOSUB1540:PRINTCHR$(186)
1130 A2=90:Z7=1:GOSUB660:Z7=0
1140 IFZ1=0THENH2=H2+1
1150 Z1=0
1160 REM
1170 REM CLEAR WORKING AREA
1180 Z5=1:A1=8:B1=24:C1=2:D1=32:GOSUB1580
1190 A1=12:B1=0:C1=39:D1=32:GOSUB1580
1200 GOTO980
1210 REM
1220 REM GENERATE TABLES
1230 GOSUB1750
1240 A1=1:D=0:J=0
1250 J=J+1:IFJ=11THEN1390
1260 D=D+1
1270 A1=A1+2
1280 E=0:B1=1
1290 FORI=1TO10
1300 E=E+1
1310 B1=B1+3
1320 GOSUB1540
```

(continued on next page)

1060 is executed. Line 1100 checks that the answer is correct; if so, line 1130 "ticks" the answer.

Line 1130 gives a time delay without printing an error message by setting Z7 to 1. Line 1140 indexes the correct-answer counter H2 if the wrong-answer flag Z1 is not set. Line 1150 clears the wrong-answer flag.

Lines 1180 to 1200 clear the working area ready to display the next question after Goto 980. I clear the working area by this method rather than by clearing the screen and re-displaying the title block as I dislike the flashing effect this gives.

Wrong-answer counter

If the answer given to the question is wrong, line 1170 calls up the display tables routine with Gosub 1480. Line 1490 indexes the wrong-answer counter H1. It should be noted that no flag is used to check if this is the first attempt at the question: the total of correct and wrong answers is greater than the number of questions if more than one attempt has been made at any question.

Gosub 1220 generates the tables. Line 1240 initialises the variables. Lines 1250 and 1380 are used in place of a For-Next loop — my Pet has a fault, and will not accept nested For-Next loops. Line 1260 indexes the table-number counter D. Line 1270 sets the line number to start to print the line of tables.

The loop 1290 to 1370 prints the line of tables on the screen by indexing E and increasing the column position B1. Line

780	This program will test your knowledge.
820	Enter the highest number of tables.
920	Do you wish to study the tables first?
940	Please enter Y or N.
1430	Question number.
1760	John Craig Tables.
1830	RESULTS
1860	Correct Wrong
1870	Answered
1980	If you have finished, enter *.
2010	Type any key when ready. Try again.

Table 1

1320 moves the cursor to the correct screen position, line 1330 calculates the number to be printed and assigns it to F$. Line 1340 builds F$ up with leading blanks to a length of 3 digits. Line 1350 checks whether F$ is the correct answer to the question and if it is, prints F$ in reverse video. Line 1360 prints F$. When the table is printed the return is at line 1390 to line 1490. The cursor is then placed at the bottom of the screen and prints the prompts EM$ (4) and EM$ (5) for time A2 set in line 1500. Line 1510 displays the question again then returns to line 1110, then back to line 1060 for a second attempt.

When a * is entered, the finish routine is called up, starting at line 1540. This routine prints the tables of results using the screen-graphic subroutines. Line 1810 prints the title block. Line 1820 prints the block of *. Line 1830 prints "RESULTS". Lines 1840 to 1870 print the headings, and line 1880 prints the underlining of the heading.

Line 1890 checks that the last question has been answered.

Lines 1910 to 1930 print the border.

Line 1940 places the cursor at the bottom of the screen.

This program was written in lower case as I wished to use the "tick" symbol, which is only available in the lower-case mode as CHR$(186). This does, unfortunately, create a problem when the program is listed in upper case, as graphic symbols are printed where capitals are used. If address 59468 is Poked with 14 before the program is entered; the text to be entered is shown in table 1.

(continued from previous page)

```
1330 F$=STR$(D*E)
1340 IFLEN(F$)<3THENF$=" "+F$:GOTO1340
1350 IFVAL(F$)=WTHENIFV=DTHENC1=2:D1=1:PRINTF$:GOSUB1670:GOTO1370
1360 PRINTF$
1370 NEXTI
1380 GOTO1250
1390 RETURN
1400 REM
1410 REM DISPLAY QUESTION
1420 GOSUB1750:A1=23:B1=0:GOSUB1540:PRINTEM$(1)
1430 A1=8:B1=10:GOSUB1540:PRINT"●UESTION NUMBER ";Q
1440 PRINT:PRINT:PRINT
1450 PRINT"                    ";V"*";Z"= ";
1460 RETURN
1470 REM
1480 REM DISPLAY TABLES IF ANSWER IS WRONG
1490 H1=H1+1:GOSUB1220:A1=23:B1=5:GOSUB1540:PRINTEM$(4);Q;EM$(5):Z1=1
1500 A2=300:GOSUB660
1510 GOSUB1410
1520 RETURN
1530 REM
1540 REM * CURSOR PLACE * A1=LINE B1=COLUMN
1550 POKE84,A1:POKE85,B1:SYS(31243)
1560 RETURN
1570 REM
1580 REM * DRAW A HORIZONTAL BAR * A1=LINE B1=COLUMN C1=LENGTH D1=CHARCTER
1590 POKE86,B1:POKE87,A1:POKE88,C1:POKE00,D1:SYS(30029)
1600 RETURN
1610 REM
1620 REM * DISPLAY BLOCK OF CHARECTER E1 *
1630 REM A1=LINE B1=COLUMN C1=WIDTH OF BLOCK D1=HEIGHT OF BLOCK E1=CHARACTER
1640 POKE86,B1:POKE87,A1:POKE88,C1:POKE89,D1:POKE0,E1:SYS(30470)
1650 RETURN
1660 REM
1670 REM * DISPLAY BLOCK IN REVERSE VIDEO *
1680 REM A1=LINE B1=COLUMN C1=WIDTH OF BLOCK D1=HEIGHT OF BLOCK
1690 POKE86,(B1+1):POKE87,A1:POKE88,C1:POKE89,D1:SYS(30510):RETURN
1700 REM
1710 REM * OUTLINE BORDER *
1720 REM A1=LINE B1=COLUMN C1=WIDTH OF BORDER D1=HEIGHT OF BORDER
1730 POKE86,B1:POKE87,A1:POKE88,C1:POKE89,D1:SYS(30090):RETURN
1740 REM
1750 REM TITLE BLOCK
1760 PRINT"❐          ˋOHN ⌐RAIG       |ABLES"
1770 A1=1:B1=7:C1=25:D1=61:GOSUB1580
1780 RETURN
1790 REM
1800 REM FINISH ROUTINE
1810 GOSUB1760
1820 A1=4:B1=10:C1=19:D1=3:E1=42:GOSUB1620
1830 A1=5:B1=12:GOSUB1540:PRINT" _ ¯ ● ╭ L | ● "
1840 A1=9:B1=6:GOSUB1540
1850 PRINT"●UESTIONS"
1860 PRINT"                  ⌐ORRECT    ○RONG"
1870 PRINT"      ♠NSWERED"
1880 A1=12:B1=5:C1=28:D1=61:GOSUB1580
1890 PRINT:IFZ1=1THENQ=Q+1
1900 PRINT"        ";Q-1;"         ";H2;"         ";H1
1910 A1=8:B1=4:C1=11:D1=8:GOSUB1710
1920 A1=8:B1=15:C1=10:D1=8:GOSUB1710
1930 A1=8:B1=25:C1=10:D1=8:GOSUB1710
1940 A1=20:B1=0:GOSUB1540
1950 END
1960 REM
1970 REM INITIALIASE DATA
1980 DATA"    ¬F YOU ARE FINISHED ENTER * "
1990 DATA"   PLEASE ENTER A NUMBER BETWEEN 1-10"
2000 DATA"    |UCK UP YOU MUST ENTER A NUMBER","TRY QUSSTION "," AGAIN PLEASE"
2010 DATA"  ***  |YPE ANY KEY WHEN READY  ***","           *** |RY AGAIN  ***"
2020 FORI=1TO7:READEM$(I):NEXT
2030 RETURN
2040 REM
2050 REM INPUT NAME
2060 PRINT"❐":A1=8:B1=0:GOSUB1540
2070 PRINT    "PLEASE ENTER YOUR NAME UNDER THE STARS"
2080 PRINT
2090 PRINT"      ******************"
2100 A1=12:B1=5:GOSUB1540
2110 GOSUB540:IFLEN(A3$)>18THEN2140
2120 IFLEN(A3$)<18THENA3$=A3$+" ":GOTO2120
2130 N$="          "+A3$:GOTO2150
2140 A2=90:Z3=7:GOSUB630:A1=12:B1=4:C1=35:D1=32:GOSUB1580:GOTO2100
2150 RETURN
2160 PRINT"❐";N$;"TABLES"
2170 GOSUB1970:GOSUB2050:GOTO770
```

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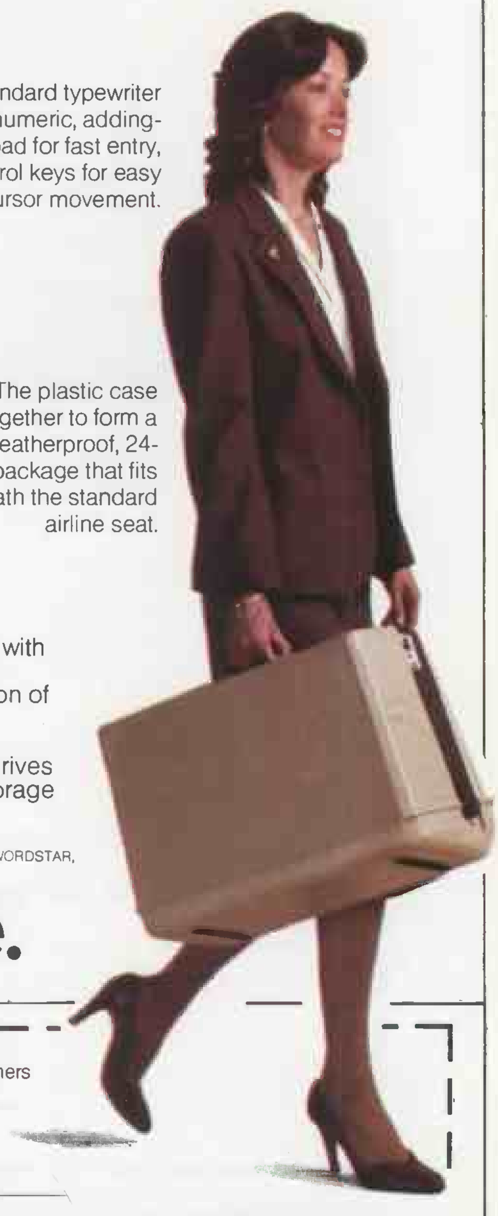

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Machine-code subroutines on the Pet

Judiciously-placed machine code can make a huge improvement to the speed at which a program runs. P H Richards reveals the secrets of the Pet's interpreter and shows how it can be harnessed to powerful machine-code routines for use within your Basic programs.

WHILE THE BASIC residing in the Pet ROM is adequate for most tasks, the programmer may wish to access machine-code routines either because Basic is too slow for a required task, or because a particular function is not implemented in Pet's version of the language.

An interpreter like Basic consists of machine-code subroutines to perform specific tasks. The required task is specified in the higher language, stored as a program, and then interpreted by scanning program lines. When a keyword is recognised, the appropriate machine-code subroutines perform the desired function.

The interpreter first finds the end of the line. It then starts to interpret the code to find tokens which the interpreter recognises. Default is the Let command.

The Pet makes machine-code subroutines available from Basic by the use of the Sys(x) command where x is the decimal start address of the subroutine. Most of the resident machine-code subroutines are of little use when called direct from Basic since routines usually assume certain values in the microprocessor registers. The most effective way to access them is from a machine-code program.

Different entry points

The examples in this article are specific to new-ROM Basic 2.0; Basic 4.0 users will probably find that the entry points to the machine-language subroutines are different.

Old-ROM users have this problem and, in addition, the references to the Tim monitor are not applicable to them.

Many readers uninterested in details of machine-language programming will have dabbled with the monitor, and may even have used some of the interesting short routines submitted by readers. Usually these instructions include the statement that "the function is initiated by Sys 826" or thereabouts. Most of these routines are designed to reside in that area of memory reserved for the second cassette buffer, which starts at memory location 826 decimal. This area is unaffected by Basic, unless you are using two cassette drives; it cannot be affected by the Basic editor and the New command leaves it untouched.

Furthermore, if a momentary power failure occurs — like switching your Pet off then on — the chances are that anything in the buffer will survive provided that the interrupt is less than one second. There are, however, problems with this location. Some commercial add-ons use the area. Basic 4.0 uses it, and if you wish to use more than one routine the total length of the machine code may exceed the available space.

If the second cassette buffer area is not available the machine code must be held in the main user area of memory. Protecting the machine-code program from the Basic interpreter is possible by writing the machine code to reside at the top of memory, and then fooling the Pet into thinking that the top of memory is lower than it is.

This is easy because Basic uses a two-byte pointer held in decimal addresses 52 (low byte) and 53 (high byte) to remember the top of memory. In a 32K Pet these pointers would contain zero and 128 decimal respectively, indicating a memory total of 32,768. Addresses zero to 1024 are reserved for Basic so that user memory is 32,768−1,024=31,744.

Poking these address pointers with lower values will protect an area of memory. If you poke 52 with zero and 53 with 80 then approximately 12K will be protected.

A number of commercial programs designed to run in conjunction with a user's own Basic program are located to top of memory in this manner. I use this method when writing large blocks of machine code. The only problems occur when I lose, or have to rewrite, a favourite block because my latest add-on uses the space I need.

Routine treatment

What I needed was a way of treating short routines as part of a Basic program. The ideal would be to make the machine code part of the Basic program with line numbers so that the Toolkit could be used when building up a program from subroutines for Renumber, Find and Delete.

This can be done by using the Rem Basic statement to protect the machine code following from the interpreter. For each program line about 70 bytes of machine code can be incorporated.

To follow the examples exactly you should have the Pet reset either by switching it off then on, or by the command Sys 64721. Now enter the line

10 REMREM******************************

entering the * symbol to the end of the Basic line. Also note that the second appearance of Rem is not a printing error. You should have managed to get 71 * symbols in your line.

Clear the screen and enter the monitor with Sys 64785 and request memory locations 0401 to 0453. If everything is in order you should see the information as shown in figure 1. Exit the monitor by typing X then return.

(continued on page 119)

Figure 1. Monitor Basic line.

```
     PC   IRQ  SR AC XR YR SP
.;  C6FB E62E 2C 34 3A 9D FA
.
.:  0401 51 04 0A 00 8F 52 45 4D
.:  0409 2A 2A 2A 2A 2A 2A 2A 2A
.:  0411 2A 2A 2A 2A 2A 2A 2A 2A
.:  0419 2A 2A 2A 2A 2A 2A 2A 2A
.:  0421 2A 2A 2A 2A 2A 2A 2A 2A
.:  0429 2A 2A 2A 2A 2A 2A 2A 2A
.:  0431 2A 2A 2A 2A 2A 2A 2A 2A
.:  0439 2A 2A 2A 2A 2A 2A 2A 2A
.:  0441 2A 2A 2A 2A 2A 2A 2A 2A
.:  0449 2A 2A 2A 2A 2A 2A 2A 00
.:  0451 00 00 AA AA AA AA AA AA
```

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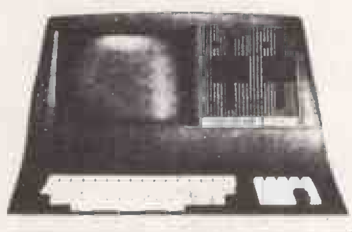

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(continued from page 117)

Location 0401, or 1025 decimal, is the start of the RAM for user programs. The first two hex numbers 51 and 04 are the low and high bytes of the address where Basic expects to find the next line for interpretation. The next two bytes 0A and 00 are the low and high bytes of the line number; 00A0 hex is 10 decimal.

Next comes the byte 8F, or 143 decimal. As the Basic interpreter enters a program line from screen to memory it looks for instructions such as Rem or Read and if they are recognised they are converted into single-byte tokens with ASCII values of 128 — End — or greater; 143 is the value of the token for Rem. Once the Basic interpreter has recognised the Rem token, following characters are stored exactly as received, which is why the following three bytes contain 52, 45 and 4D respectively — the hex representations of decimal 82, 69 and 77. They are the ASCII values of R, E and M. The second Rem entered has been treated as received and not tokenised.

End of program

The rest of the line to memory 044F consists of 2A which represents the * character. The three 00 bytes following signify the end of the program since the first two bytes signify that no further lines follow, and the third that the current line is ended.

Now re-enter the monitor and place the cursor over the first of the 2A bytes and alter it to 8F, which is the token for the Rem statement. Now exit the monitor and List. The List command reverses the process of the line entry, with the exception that the program assumes that if a byte has a token value then it is a token, and the appropriate command is printed. If you were to alter all of the 2A bytes to 8F via the monitor then a List would produce a very long program line.

Enter the monitor and change the second 8F back to a 2A and then exit the monitor and List. Now place the cursor over the line number 10 and edit to 99. Delete line 10 by typing 10 then pressing Return. Now enter and examine the line from the monitor. Nothing has changed apart from the line number and the fact that you probably lost one of the * symbols during your line edit.

It appears possible to alter the line via the monitor to include a machine-code routine. If the line starts with a Rem statement then the line can be renumbered, and can be stored on tape or disc like any other line.

However, an important snag in this apparently simple approach can be demonstrated by trying to make the Pet break to the Tim monitor. When the 6502 processor meets a 00 byte instruction it causes a software interrupt which on the Pet calls the monitor.

Using the monitor alter the first of 2A bytes to 00. Then exit the monitor and type Sys 1033. You should have entered the monitor via a break signified by a B* at the start of the monitor listing. Now look at the program by typing M 0401 0530. The zero byte is now in the place of the first 2A.

```
     PC   IRQ  SR AC XR YR SP
.;  C6FB E62E 34 37 38 35 FA
.
.:  0401 50 04 00 00 8F 52 45 4D
.:  0409 A0 01 A2 01 BD FF 7F 18
.:  0411 69 80 9D FF 7F E8 E0 FF
.:  0419 D0 F2 E8 18 BD FE 80 18
.:  0421 69 80 9D FE 80 E8 E0 FF
.:  0429 D0 F2 E8 18 BD FD 81 18
.:  0431 69 80 9D FD 81 E8 E0 FF
.:  0439 D0 F2 E8 18 BD FC 82 18
.:  0441 69 80 9D FC 82 E8 E0 EC
.:  0449 D0 F2 60 23 23 23 00 00
.:  0451 00 AA AA AA AA AA AA AA
```

Figure 2. Screen-image reverse routine.

Exit the monitor and List the line. See that the listing does not include any of the * symbols. The Basic interpreter always sees a zero byte as meaning the end of a program line, hence it assumed that the zero byte meant the end of line 99. It then moved on trying to make sense of the rest. It failed because it tried to interpret the following symbols as being present in the expected format.

Figure 3. Code for reverse screen.

```
A0 01       Load Y reg with 1
A2 01       Load X reg with 1
BD FF 7F    Load Accumulator from
            $7FFF + X reg contents
18          Clear Accumulator Carry Flag
69 80       Add $80 to accumulator
9D FF 7F    Store in $7FFF+ X reg
            contents
E8          Increment X register
E0 FF       Compare X reg with $FF
D0 F2       Branch if not zero
E8          Increment X Register
18          Clear Carry
BD FE 80    Load from $80FE + X
18
69 80
9D FE 80    Store in $80FE + X
E8
E0 FF
D0 F2
E8
18
BD FD 81    Load from $81FD + X
18
69 80
9D FD 81    Store in $81FD + X
E8
E0 FF
D0 F2
E8
18
BD FC 82    Load from $82FC + X
18
69 80
9D FC 82    STORE in $82FC + X
E8
E0 EC
D0 F2
60          RTS
```

Now try to run the line. Remember that the Run command was followed by Ready, indicating that the Rem statement had been ignored. If you are lucky, and have a 32K Pet, then the return message will be

?SYNTAX ERROR IN 10794

The Basic interpreter ignores the Rem statement but assumes that the single byte means the end of the line. The address of the next line given at the start of the line is not used in normal execution.

Major fault

The Interpreter assumes that the next line starts immediately after the single zero byte. It ignores the next two bytes — 2A,2A — and sees the following two bytes — 2A,2A — as the current line number, in this case 2A2A hex or 10794 decimal. The interpreter then parses along this line looking for an instruction until it gives up and exits via the syntax error message. Thus we cannot incorporate a machine-code routine into a Basic line if it has a zero byte in the listing. Even with this major fault, however, you can write a number of useful routines.

Figure 2 shows how a routine for reversing the screen image would appear in the Basic line. First clear Basic with Sys 64721 and then enter the line

0 REMREM

followed by the rest of the line in # symbols, to duplicate the example exactly. Start altering, via the monitor, to the codes shown in the listing. Note that the AA bytes following the three zero bytes are not part of the required routine.

Once you have entered the code, exit

(continued on next page)

```
 62000 REM TO LOCATE UP TO 'N' MACHINE CODE SUBROUTINES IN REM STATEMENTS IN ORD
ER
 62002 REM OF THEIR APPEARANCE
 62004 REM THIS ROUTINE SHOULD BE CALLED AT THE START OF THE PROGRAM USING THE C
ODE
 62006 REM THE SUBROUTINE SHOULD BE ENTERED WITH SY SET TO THE MAXIMUM NUMBER OF
 62008 REM ROUTINES AVAILABLE AND SUBROUTINES STORED IN LINES BEGINNING REMREM
 62010 DIMSY(SY):SS=PEEK(43)*256+PEEK(42):N=1:FORI=1024TOSS
 62012 IFPEEK(I)=143ANDPEEK(I+1)=82ANDPEEK(I+2)=69ANDPEEK(I+3)=77THENSY(N)=I+4
 62014 IFSY(N)=I+4THENN=N+1:IFN>SYTHENI=SS
 62016 NEXT:RETURN
```

Figure 4. Basic program to find machine code in RemRem lines.

(continued from previous page)
the monitor and type Sys 1033 followed by Return. The screen should reverse to black on white. Type Sys 1033 again to recover the normal screen. When you are satisfied that the routine works then save the line to tape or disc. The logic of the routine is given in figure 3.

The routine examines screen memory in four blocks; three of 255 bytes and one of 236 bytes. The routine could have been much shorter were it able to reside in a fixed location. Each location on the screen memory has 128 decimal added to its value and this provides the reversal. Indirect addressing of the screen is via the X register, which is incremented in the first block from 1 to 255 and thereafter from 0 to 255.

This program demonstrates one way round the problem of not having a zero byte. If it is particularly desired to initialise a register with 0 then you could load the register with 1 and then use a decrement instruction. The call Sys 1033 was used to activate the machine-code subroutine because it is known exactly where in memory the program was located. To be completely portable, however, the routine must be able to be at any point in memory.

All of the routines so far have started with two typed Rems of which only the first was tokenised. Thus each line starts with the decimal numbers 143, 82, 69, 77. This pattern can be used to identify the start of a machine-code routine. If Peek(x)=143, Peek(x+1)=82, Peek(x+2)=69 and Peek(x+3)=77 then Peek(x+4) is the start of the routine. A continued search would find any other routines hidden in this way.

Figure 4 gives a Basic subroutine to locate up to N machine-code subroutines in this way and to put the start addresses into the array SY(N). If this subroutine is called at the start of a program, the subroutines can be called by Sys(SY(X)) where X is the number between 1 and N of the routine required. The subroutine must be entered with N set. The method of identification precludes the inclusion of such program lines as

```
100 REMREMOVE THE . . .
```

The method is easily modified to other identifying sequences. For instance you may wish to use Rem followed by a shifted graphic character.

These routines may be renumbered by software such as Toolkit without any ill effects. If you have attempted a Basic List of the screen-reverse program you will be aware that the screen editor may not be used. If you have not yet listed them, do so now.

The line 0 when listed occupies about five screen lines on a 40-column Pet. Any attempt to change the line number using the screen editor will truncate the routine. You can renumber a line via the Tim monitor to change bytes 3 and 4 of the line to the desired value. Assuming that the screen-reverse routine is still in memory, try the following:

```
20 IF X=0 THEN X=1:GOTO 42
30 IF X=1 THEN X=2:GOTO 42
40 PRINT X
```

Now enter the monitor and look at line 0. The line number is given in the third and fourth bytes of the line which, at the moment, read 00 00. Change the first byte to read 2A then exit the monitor and List. Although the line number of the routine has been changed it is still in the same place in the listing. Running the program will give a value for X of 2 on the screen, proving that Basic accepts the new line number as valid.

This also demonstrates how Goto works. The interpreter starts from the first location in Basic and looks for a line number match, without reference to the present line number. If the interpreter meets a higher line number than that for which it was searching then an unidentified-statement error is issued. Change the 42 in line 20 to 20, and the program will give an error.

This only works if you enter the whole thing again. The modification to the line number must be the final edit. If you have not got a Toolkit or similar then you should reserve some line numbers exclusively for these machine-code routines.

Short routines of this type give access to the wealth of machine-code routines forming the Basic interpreter. Figure 5 shows how to access a number of these routines and it provides, on call, the current value of the variable I to the top-left corner of the screen. The routine calls subroutines in the Basic interpreter.

First it calls CFC9 hex which locates a variable, then E25D hex which positions the cursor for printing, before DAAE hex loads the current value of the variable into the floating-point accumulator and DCE3 hex prints it on the screen. The final call to E25D hex resets the cursor position.

Figure 5. Program to access routines from Basic interpreter.

```
    PC  IRQ  SR AC XR YR SP
   C6FB 9B28 2C 34 3A 9D FA

   0401  50 04 0E 03 8F 52 45 4D
   0409  18 A5 98 C9 F0 01 60 A9
   0411  49 85 42 A5 98 85 43 20
   0419  C9 CF A5 C6 8D 70 03 A5
   0421  D8 8D 71 03 A9 01 85 D8
   0429  85 C6 20 5D E2 A5 44 A4
   0431  45 20 AE DA 20 E3 DC AD
   0439  70 03 85 C6 AD 71 03 85
   0441  D8 20 5D E2 60 23 23 23
   0449  23 23 23 23 23 23 00 00
   0451  00 44 D3 28 3A 03 00 00
```

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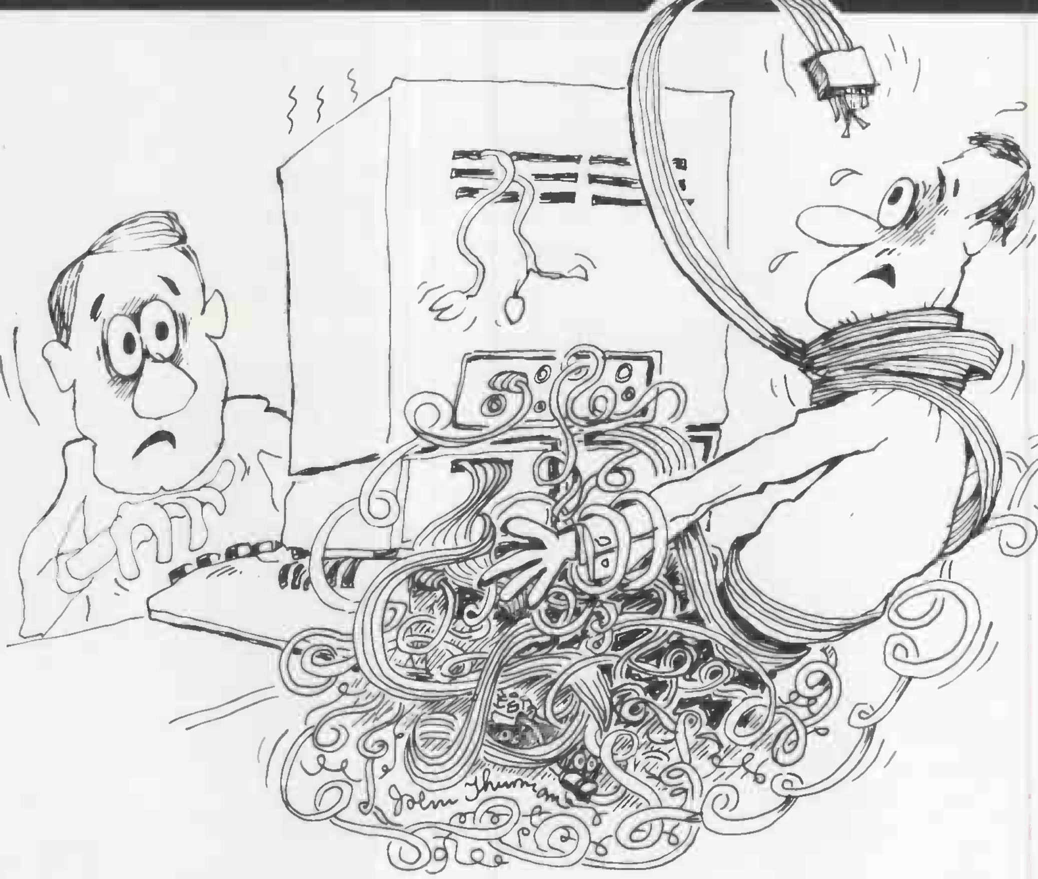

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TWENTYONE – a dice version of Blackjack.

COMBAT – you're on a suicide space mission. You have only 12 missiles but the aliens have unlimited strength. Can you take 12 of them with you?

SUBSTRIKE – on patrol, your frigate detects a pack of 10 enemy subs. Can you depth-charge them before they torpedo you?

CODEBREAKER – the computer thinks of a 4-digit number which you have to guess in up to 10 tries. The logical approach is best!

MAYDAY – in answer to a distress call, you've narrowed down the search area to 343 cubic kilometers of deep space. Can you find the astronaut before his life-support system fails in 10 hours time?

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Finding the significance of the differing averages of two sets of data is a common problem. Malcolm Mountford demonstrates an improved randomisation test.

Correlation

THE EXCELLENT ACCOUNT of the rationale of Fisher's two-sample randomisation test given by Owen Bishop in *Practical Computing*, February 1981 is marred by an erroneous procedure and an incorrect algorithm. The test is based on the following argument.

Suppose that N individuals are drawn randomly from one population and M individuals are drawn randomly from a second population.

Each individual is weighed.

If the two populations are identical all partitions of the total of (N+M) individuals into two groups of N and M individuals are equally alike.

Let X be the mean of the first sample and Y the mean of the second sample.

For each of the (N+M)!/(N!M!) partitions there is a corresponding value of X−Y.

The probability level of the observed difference between means is the proportion of possible values of X−Y that are greater than or equal to the observed value of X−Y.

Bishop argues that to calculate this proportion it is not necessary to consider all (N+M)!/(N!M!) partitions, and that it is sufficient to consider merely the interchanges of values in the region of overlap of the two samples. To illustrate the point, the numerical example given by Bishop is repeated here. He considers the comparison of two samples of weights:

Sample A has weights 495, 490, 497, 493, 500; means = 495

Sample B has weights 499, 500, 502, 496, 503: mean = 500.

The two samples are then separately sorted in ascending order and then arranged as shown in Table 1.

Owen Bishop then argues that if we want to make the sample with the largest mean, sample B, even larger, it is a waste of time to consider swapping any member of B for the three smallest members of A, 490, 493, 495. Similarly we would not consider swapping the two largest members of B, 502 and 503, for any in A. The only values which are concerned with the selection process are those of the overlap group.

This argument is correct only if exchanges are made one at a time. However, let us consider what may happen when exchanges are made two at a time. In particular consider swapping the two values 495 and 500 of sample A with the two values 496 and 499 of sample B. The resulting partition has the same mean difference, and should therefore be taken into account.

Evidently it is incorrect merely to consider exchanges one at a time; it is also necessary to consider swapping members two at a time, three at a time and so on. To follow the correct procedure it would be

(continued on next page)

Table 1.

A	490 493 495	497 500	
B		496 499 500	502 503
	smaller	overlap	larger

```
0010 REM FISHER'S TWO-SAMPLE RANDOMISATION TEST FOR IDENTICAL POPULATIONS.
0020 REM SENSITIVE TO UNEQUAL LOCATIONS.
0030 REM
0040 REM PROGRAM RETURNS PROBABILITY LEVELS FOR ONE-TAILED AND TWO-TAILED TESTS.
0050 REM
0060 DIM X(20),Y(20),Z(40),J(20),T(3),P(3)
0070            PRINT TAB(18);'RANDOMISATION TEST'
0080            PRINT
0090            LET N1=0
0100            LET N2=0
0110 REM INPUT VALUES,X(I),OF FIRST SAMPLE AND COMPUTE SIZE OF SAMPLE.
0120 REM
0130 PRINT 'ENTER VALUES OF FIRST SAMPLE EACH FOLLOWED BY EOL'
0140 PRINT 'AFTER FINAL ITEM TYPE END'
0150 PRINT
0160 FOR I=1 TO 10000 STEP 1
0170 DISP 'ENTER VALUE.IF NO MORE TYPE END',
0180 INPUT X$
0190 IF X$='END' THEN 230
0200 ASSIGN X$,X(I);32
0210 LET N1=N1+1
0220 NEXT I
0230            PRINT 'VALUES OF FIRST SAMPLE'
0240            PRINT
0250            FOR I=1 TO N1 STEP 1
0260            PRINT X(I)
0270            NEXT I
0280 REM INPUT VALUES,Y(I),OF SECOND SAMPLE AND COMPUTE SIZE OF SAMPLE.
0290 REM
0300 PRINT 'ENTER VALUES OF SECOND SAMPLE EACH FOLLOWED BY EOL'
0310 PRINT 'AFTER FINAL ITEM TYPE END'
0320 FOR I=1 TO 10000 STEP 1
0330 DISP 'ENTER VALUE.IF NO MORE TYPE END',
0340 INPUT Y$
0350 IF Y$='END' THEN 390
0360 ASSIGN Y$,Y(I);32
0370 LET N2=N2+1
0380 NEXT I
0390            PRINT 'VALUES OF SECOND SAMPLE'
0400            PRINT
0410            FOR I=1 TO N2 STEP 1
0420            PRINT Y(I)
0430            NEXT I
0440            PRINT
0450 REM CALCULATE OBSERVED DIFFERENCE BETWEEN MEANS.
0460 LET S1=0
0470 LET S2=0
0480 FOR I=1 TO N1 STEP 1
0490 LET S1=S1+X(I)
0500 NEXT I
0510 FOR I=1 TO N2 STEP 1
0520 LET S2=S2+Y(I)
0530 NEXT I
0540 LET Q=1
0550 IF N2>N1 THEN 600
0560 LET R=N2
0570 LET M=N1
0580 LET Q=2
0590 GOTO 620
0600 LET R=N1
0610 LET M=N2
0620 LET D1=S1/N1-S2/N2
0630 LET D=ABS(D1)-1E-30
0640 REM      THE TWO SAMPLES ARE MERGED.
0650            LET N=N1+N2
0660            LET S3=(S1+S2)/M
0670            FOR I=1 TO N1 STEP 1
0680            LET Z(I)=X(I)
0690            NEXT I
0700            FOR I=1 TO N2 STEP 1
0710            LET Z(N1+I)=Y(I)
0720            NEXT I
0730 REM GENERATION OF ALL PARTITIONS BY THE ALGORITHM PROVIDED
0740 REM BY JANE GENTLEMAM IN APPLIED STATISTICS 1975,P374.
0750 REM
0760 FOR I=1 TO 3 STEP 1
0770 LET T(I)=0
0780 LET P(I)=0
0790 NEXT I
0800 LET I1=1
0810 IF (R<1) OR (R>N) THEN 1310
0820 LET I1=0
0830 LET K0=0
0840 LET M=N-R
0850 LET I=1
```

(listing continued on next page)

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necessary to sort paired values in ascending order to establish the overlap for members exchanged two at a time, then to sort in ascending order values taken three at a time, and so on. This method leads to large demands on sorting procedures and also to large storage requirements. Thus if a sample has 15 members, storage capacity of 15!/(8!7!) = 6,435 values is required. The sorting procedure needed to cope with this number is correspondingly expensive.

These problems of storage, sorting and indeed of programming are avoided by simply evaluating the values of the difference between means X−Y for all possible (N+M)!/(N!M!) partitions. It is then a straightforward procedure to evaluate the probability levels for one-tailed and two-tailed tests.

In outline, the Randomisation program is as follows:

Lines 70-350. The data for the two samples is entered.

Lines 370-540. The observed difference is computed.

Lines 550-620. The values of the two samples are merged.

Lines 670-1010. All partitions are generated by the algorithm provided by Jane Gentleman in *Applied Statistics* (1975), page 374. The values of X−Y for each partition calculated in lines 800-940.

Lines 1020-1300. Printout of probability levels for one-tailed and for two-tailed tests.

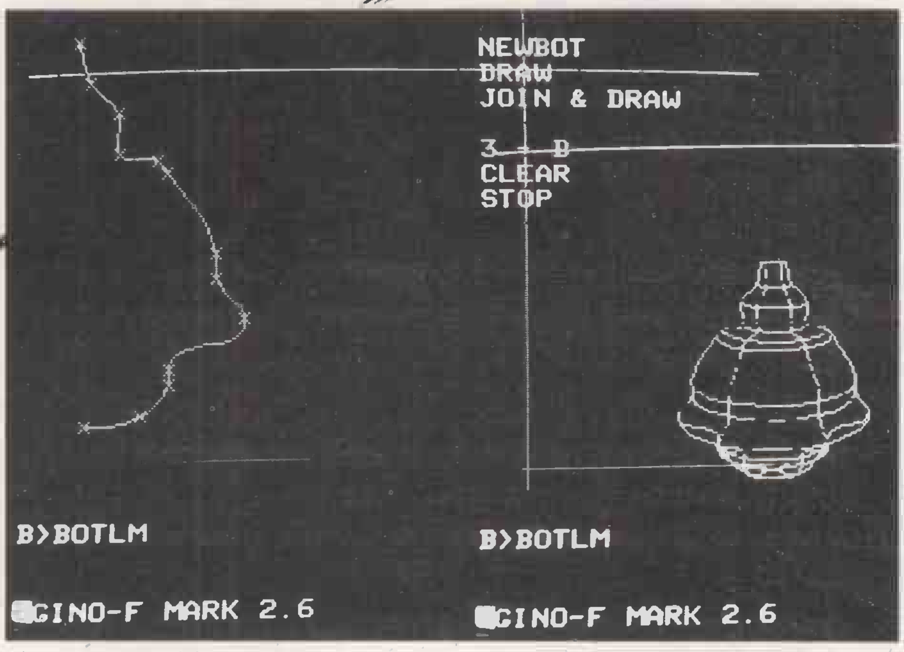
(listing continued from previous page)

```
0860 LET J(1)=1
0870 IF I=R THEN 920
0880 LET P1=I+1
0890 FOR L=P1 TO R STEP 1
0900 LET J(L)=J(L-1)+1
0910 NEXT L
0920 LET K0=K0+1
0930 LET S=0
0940 FOR I=1 TO R STEP 1
0950 LET L=J(I)
0960 LET S=S+Z(L)
0970 NEXT I
0980 LET S=S*N/(R*M)-S3
0990 REM NOTE THAT THE DIFFERENCE BETWEEN MEANS=S.
1000 IF Q=1 THEN 1020
1010 LET S=-S
1020 IF S<D1-1E-10 THEN 1060
1030 REM COMPUTE THE NUMBER OF PARTITIONS IN THE ONE-TAILED AND TWO-TAILED
1040 REM CRITICAL REGIONS.
1050 LET T(1)=T(1)+1
1060 IF S>D1+1E-10 THEN 1080
1070 LET T(2)=T(2)+1
1080 LET S=ABS(S)
1090 IF S<D THEN 1110
1100 LET T(3)=T(3)+1
1110 LET I=R
1120 IF J(I)<M+I THEN 1160
1130 LET I=I-1
1140 IF I<=0 THEN 1180
1150 GOTO 1120
1160 LET J(I)=J(I)+1
1170 GOTO 870
1180           FOR I=1 TO 3 STEP 1
1190           LET P(I)=T(I)/K0
1200           NEXT I
1210 REM PRINT-OUT OF PROBABILITY LEVELS OF ONE-TAILED AND TWO-TAILED TESTS.
1220 PRINT "MEAN OF FIRST SAMPLE=";S1/N1
1230 PRINT
1240 PRINT "MEAN OF SECOND SAMPLE=";S2/N2
1250 PRINT
1260 PRINT "PROBABILITY LEVEL FOR A TWO-TAILED TEST=";P(3)
1270 PRINT
1280 PRINT "PROBABILITY LEVEL FOR ONE-TAILED TEST(1ST>2ND)=";P(1)
1290 PRINT
1300 PRINT "PROBABILITY LEVEL FOR A ONE-TAILED TEST(2ND>1ST)=";P(2)
1310 END
```

In these pages Brian Reffin Smith keeps you up to date with computer-based art and design and lays the foundations for graphics routines to use on your own micro.

All-purpose graphics routines from Gino

SQUEEZING GINO into a micro is the artistic equivalent of putting all the Pentagon's computers onto a single chip. The Computer-Aided Design Centre, CADC, at Cambridge, originally designed Gino for large mainframe computers and it has become the best-known general-purpose graphics package around. This library of Fortran subroutines has traditionally cost thousands of pounds to buy or even hire because it can perform tasks ranging from information graphics to map making, and from equipment design to architecture.

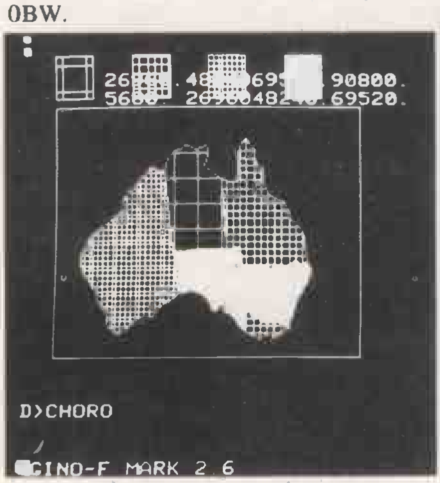


Machine-portable

Now Research Machines has made all this available to micro users for a few hundred pounds. The general-purpose Gino-2D comes on a 5·25in. mini-floppy. It is also available on 8in. disc, as are Gino-zone for mapping, Gino-graph for information graphics, and even the massive Gino-F which can perform two- and even three-dimensional routines. These all run under CP/M, and of course need Fortran, and a text-editor to write the programs.

Gino is device-independent, and so will drive a Tektronix display, plotter or printer as well as the 256 colours of the Research Machines 380-Z's high-resolution graphics. The CADC has routines to drive a huge range of peripheral equipment. The packages cost no more than many word-processing packages.

The transition from Basic to Fortran is not hard, because the two languages are closely related. Details from Research Machines, Mill Street, Oxford OX2 0BW.



When a student walks into the computer studio raving about a dictionary you tend to think "What has all this got to do with computer graphics"?

Visual thesaurus

The answer lies on every one of the 820 pages of the *Oxford-Duden Pictorial English Dictionary* published by Oxford University Press in September 1981 for £7.50. The book, with over 28,000 illustrations, is a kind of pictorial equivalent of *Roget's Thesaurus.*

Each page is reminiscent of a screen-full of information, with a picture in the upper half and a numbered key in the lower portion. Each image is a story or scenario, combining all the elements thought relevant to some topic — and topics range from information technology to reptiles, from printing processes to political meetings. You can look up almost anything in the huge index and find a picture of it, in context: e.g., garters appear under "night club", complete with strippers and tired businessmen.

BBC sound

THE BBC COMPUTER is far more powerful than expected. The designers have been so clever with the graphics and the Basic that they have probably also put a lot of thought into the operating system, sound, and so on.

To give an indication of just how useful this machine can be for artists suffice it to say that the FX commands and the VDU drivers allow a user to roam around inside the system thus making the machine doubly powerful. The sound routines that are built into Basic give anyone who buys a BBC machine a free music synthesizer. The two relevant keywords are Sound and Envelope. Sound causes the internal loudspeaker to emit a tone whose frequency, volume and length can be specified. The machine can play up to four sounds simultaneously, using four channels, the first of which is a noise generator. The command looks like

```
SOUND 1,-15,100,50
```

where the 1 is the channel, and −15 the volume; 15 is the maximum value, which is always given a minus sign to distinguish it from more complex sounds. Parameter 100 is the pitch and 50 the duration of the note in units of 0.05s. Each increase of the pitch by one gives a rise of one-quarter of a semitone. The duration and

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pitch can take any value zero to 255, with a duration of 255 playing for ever.

The noise generator on channel 0 has the following properties — the number gives the pitch setting.

0 high-frequency periodic noise
1 medium-frequency periodic noise
2 low-frequency periodic noise
3 periodic noise whose frequency is determined by the pitch setting
4 high-frequency white noise (many frequencies at once)
5 medium-frequency white noise
6 low-frequency white noise
7 noise whose frequency is continuously determined by the pitch of channel 1

The first, channel, number can be a four-digit hexadecimal number, preceded by &, enabling notes to be synchronised, to wait for each other to die away, and so on. The second parameter, normally controlling volume, can instead be given a positive number of one to four, specifying an Envelope to be used for that sound. Envelope controls to a remarkable extent the sort of sound that is produced; it determines, for instance, whether a sound is piano-like — starting loud, then dying away — or more like a violin, or a motor-bike.

In this example there are 14 parameters to the Envelope command, which are then used by Sound at line 20:

```
10 ENVELOPE 3, 25, 16, 12, 8, 1, 1, 1, 10,
   −10, 0, −10, 100, 50
20 SOUND 1, 3, 100,100
```

The first parameter, 3, gives the envelope number. The next, 25, gives the length of step in 100ths of a second, used by later parameters. It is these that control the Envelope of pitch, the values 16, 12, 8, 1, 1, 1, and that of amplitude or volume, the final six. The attack, sustain, decay and release of the note are determined by these values.

The pitch of the note can be changed in three sections, and for each of them the change in pitch for each step is given. In our example the three sections have pitch changes of 16, 12 and 8 units. All three sections have only one step. The final values should be played with to see what they do. They can take values as follows:

The 9th can be	−127 to 127
10th	−127 to 127
11th	−127 to 0
the 12th	−127 to 127
the 13th	0 to 126
the last one can be 0	to 126.

Good luck.

BEGINNING GRAPHICS

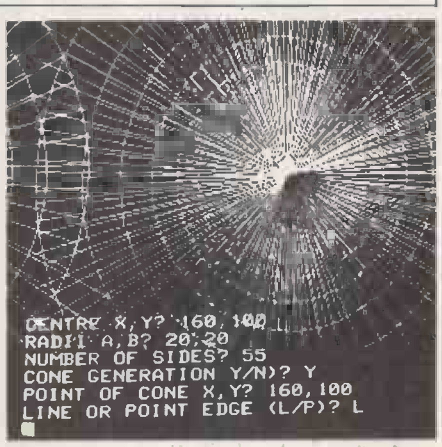
Ever-increasing circles

HERE IS AN EXTENSION to the Cones program for the 380-Z, that spirals over outwards. You can put the point of a cone inside its own rim, thus making a flower or spoked wheel. This program alters the angle to make a never-ending polygon.

```
100 REM***SPIRALS FOR RESEARCH MACHINES
          380Z WITH HI-RES GRAPHICS
110 CLEAR100
120 CALL"RESOLUTION",0,2:PUT12
130 RANDOMIZE
140 FORI=0TO3:CALL"COLOUR",I,INT(255*RND(1)):NEXTI
150 I=0
160 INPUT"CENTRE X,Y";HS,VS
170 INPUT"RADII A,B";A,B
180 INPUT"NUMBER OF SIDES";N
190 INPUT"CONE GENERATION Y/N)";ZC$:IF ZC$="N"THEN220
200 INPUT"POINT OF CONE X,Y";PX,PY
210 INPUT"LINE OR POINT EDGE (L/P)";Z$:IF Z$="P"THENSW=99
220 ANGLE=2*3.142/N
230 C=COS(ANGLE-.04):S=SIN(ANGLE)
240 XA=1:YA=1
250 I=I+1
260 COL=INT(I/N)+1:IFCOL=4THENI=1
270 X=XA*C-YA*S
280 Y=XA*S+YA*C
290 XA=X:YA=Y
300 IFI>1THENP$="LINE"ELSEP$="PLOT"
310 IFSW=99THENP$="PLOT"
320 CALLP$,A*XA+HS,B*YA+VS,3
330 IF ZC$="N"THEN350
340 CALLP$,PX,PY,COL:CALL"PLOT",A*XA+HS,B*YA+VS,16
350 GOTO250
```

ANALOGY BOX

What would the competition dictionary be like if it used sounds instead of pictures? Could it be simulated on a screen using a computer with built-in sounds such as the BBC, Atari or DAI?



Competition

WE WERE inundated with high-quality entries for the For-Next loop artwork competition. Half of them were for bizarre machines but John Hardman's winning entry was a simple concise program for a 380-Z. If you want to win this month's prize, the *Oxford-Duden Pictorial Dictionary*, try writing a program to draw a few simple objects on the screen. Refer to them by a numbered key, 1=Car, 2=Frog. Now scramble objects and descriptions so that the "wrong" ones are matched — a Car may be labelled as a Frog, for example. The winning entry will not only be amusing but will shed a new light on ordinary objects. Send your entry which cannot be returned, to Art, *Practical Computing*, Room L306, Quadrant House, The Quadrant, Sutton, Surrey, SM2 5AS.

BBC: sky is the limit

Is Acorn bidding to become the IBM of 1984? Martin Hayman looks at the progress being made by BBC and Acorn engineers towards software-programmable "data grabbers".

ANYONE who threw caution to the winds and, on inspecting the spec of the BBC Micro last year decided there and then to put in an order will now be indulging in some smug self-congratulation. A cunning entrepreneur who ordered up several will be even more pleased at the profits to be taken from immediate resale of this machine, which looked from the start to be exceptionally good value, despite the Ferranti ULA chip malfunction.

Acorn is said to have licked this problem now; certainly at the launch party for the Micro and for the TV series, *The Computer Programme,* which accompanies it, there was a good score of the machines being bashed by skilled and not-so-skilled operatives. Among them, tucked away in the corner, was one with a prototype videotex extension. It was a development job, to judge by the quantity of surrounding test gear, but it was, nevertheless, capturing data off-air from the BBC's Ceefax teletext service, as was demonstrated when someone unconnected with the computer's launch unplugged the aerial on the roof.

Teletext bias

The main thrust of the BBC Micro's videotex development work is going into the teletext side — not surprisingly as the BBC is a broadcasting organisation. But the development team, headed by a ubiquitous figure who declines any further mention in these columns, is extending maximum co-operation to British Telecom in attempting to maintain compatibility with its Prestel system.

It is not an easy task: as a marketing exercise it might seem redundant, for Prestel has climbed now to only around 15,000 registrations, while by the end of the year, it is confidently predicted, there will be more than 1,000,000 teletext sets in use in the U.K.

But is all as it seems? The Government's own document, *Information Technology*, devised by the Advisory Committee for Applied Research and Development, ACARD, alludes with some sympathy to the drudgery of drafting standards in electronic communications, and who would blame an engineer for assigning priority, when drafting standards, to his own area of interest? It is cheering, then, to find that Ceefax enhancements will make it appear to the user more like Prestel.

Such a structure could be useful for data within a telesoftware program, or for documentation. Equally it would be suitable for magazine-type editorial content where news in brief could be followed down the tree to its more detailed report. These hooks in the structure of teletext were built in by the system's technical designer, John Chambers. They are to exploit fully the increasing capacity of teletext, which now transmits on four blanking lines instead of two, and to make it, so far as possible, "futureproof".

Chambers explains that teletext files are sent in block of 1K with a "cyclic redundancy check" signalled by a flag bit which, in his words, is to "check the page is OK without having to eyeball it to make sure it makes sense". Teletext is prone to errors caused by atmospheric disturbance — low-flying aircraft, for example — so its need for error detection is no less than Prestel's, as any viewer of standard "editorial" teletext will attest.

Used as a medium for software transmission, teletext may offer some real advantages over Prestel though converting broadcast, i.e., teletext-formatted program files into executable code within your own machine via the TV screen may involve some delicate hedging around Home Office rules on subliminal broadcasting.

It is hard to know whether the same rules would apply to a "data grabber" between a TV aerial and a microcomputer. Such a box, first mooted in these pages in July 1980 by Oracle's John Hedger, would be dedicated to deformatting and checking broadcast telesoftware and would squirt the code straight into your machine.

Why not radio?

In March 1980 Hedger put the breakthrough price for such a device at £100, and Chambers now reckons that the BBC design could be sold for £115. A Labgear adaptor, which admittedly has its own power supply and infra-red control, costs about £200. A further advantage of such a data grabber is that it would be able to address pages outside the range of the standard teletext decoder. So why not just use the radio? Indeed, as we reported in January 1982, this is perfectly possible and being done in Holland — and, so we hear, by the Open University here.

In this context the BBC Micro's system is little different from an adaptor, though its error detection is, according to Chambers, slightly different from his. However — and here we come to the nub of the argument — he refers to its operation as "software-programmable". On first investigation, it seemed that what was intended was a portable system: the teletext/Prestel receiving part of the machine could be programmed to understand any protocol sent to it.

Emulators seem to be in vogue at the moment, as you will know from Commodore's recent news that it is to market plug-in circuitry to make the Commodore 64 behave as its rivals Apple, Tandy and IBM. ITT's Business Systems' "Information Transfer Technology" proposes to insert some local intelligence into a network to act as an interpreter in front of the terminal, and can appear as a telephone, teleprinter, VDU or what-have-you.

Seeking portability

The BBC Micro is different. The hitherto anonymous consultant to Acorn, Mel Pullen, is a proponent of machine-independent programs and argues that little has been done on this front since Alan Turing discussed it 20 years ago, and suggests that portable compilers such as Forth and Mint are the answer. His object appears to be to implement some such system on the BBC Micro, whereby the protocol in which a teletext/Prestel program is sent is indicated at the start of transmission: in plain terms, the rules precede the program. The machine first loads the rules, and then converts its front end to decode the program which follows according to the rules of that protocol.

Chris Oswald, a resourceful undergraduate at Cambridge University, who seems to spend his holidays working for Logica and CET, has written a paper for Acorn in which he outlines in some depth the case for, and implementation of, "A Redefinable Telesoftware Format". Such a format would, he claims

- reduce the arguments over the choice of a standard to an agreement on the default format,
- encompass a wide range of fixed telesoftware formats,
- provide for future expansion.

But other experts are not so sure. How do you instruct a receiving machine, i.e., a BBC Micro, with new rules for a format unless it already understands the machine-level language of the machine which is sending the formatted program file? Would the Acorn product be able to talk to a Research Machines 380-Z without the undesirable hardware fix?

It seems rather like trying to teach a complex system of contract bidding to someone who doesn't know how to play bridge. Or is this Acorn's bid to become the IBM of 1984?

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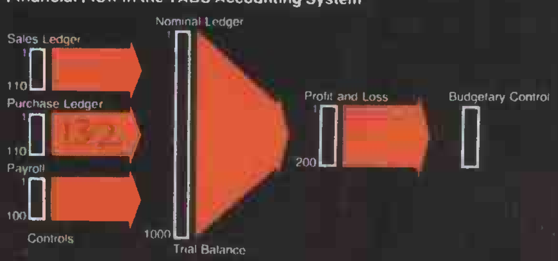

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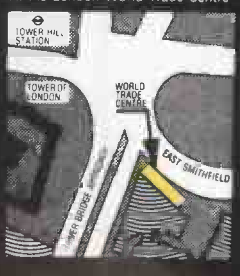

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Accounting Business Systems TABS

Reader Survey

The microcomputer market is so big, fast-moving and disorganised that information about it is hard to come by. We would like to know more so that we can plan *Practical Computing* better. Industry and government need to know so that products and services can be provided to satisfy microcomputer users' needs.

We would be most grateful for your answers to the questionnaire below. Please send it to The Editor, *Practical Computing*, Quadrant House, The Quadrant, Sutton, Surrey, SM2 5AS. As an inducement to our busy readers three cash prizes will be awarded — one of £50 and two of £25 — to the first three completely answered questionnaires drawn on May 17, 1982. Employees of IPC and their families are not eligible.

Please place a tick in the boxes provided — you may need to tick more than one box in some questions — or write your answer in the space provided.

0. Into which of these ranges does your age fall?
   under 21 ☐ 1 21 to 30 ☐ 2 31 to 40 ☐ 3 41 to 50 ☐ 4 51 to 60 ☐ 5 over 60 ☐ 6

1. Do you read *Practical Computing* mainly because of your: Job ☐ 7 Formal study ☐ 8
   Hobby/self-education ☐ 9?

2. If you read *Practical Computing* for your job or formal study please indicate
   a) Your job-title/occupation ....
   b) The nature of your organisation ....
   c) The number of people employed at your establishment:
   under 10 ☐ 10 10 to 24 ☐ 11 25 to 99 ☐ 12 100 to 249 ☐ 13 250 to 1,000 ☐ 14 over 1,000 ☐ 15

3. Do you regularly use a microcomputer? Yes ☐ 16 No ☐ 17

4. If you answered yes to question 3, what type of machine is it?
   Pet ☐ 18 Apple ☐ 19 Tandy ☐ 20 CP/M ☐ 21 Acorn ☐ 22 ZX-80/81 ☐ 23 BBC ☐ 24
   Vic-20 ☐ 25 Nascom ☐ 26 Other ☐ 27 If "other", please specify ....

5. Do you regularly use any of these peripherals?
   Cassette ☐ 28 Printer ☐ 29 Discs 5.25 in. ☐ 30 Discs 8 in. ☐ 31 Hard discs ☐ 32
   Plotter ☐ 33 High-resolution graphics ☐ 34

6. What is the approximate value of the system you use most?
   Under £100 ☐ 35 £100 to 299 ☐ 36 £300 to 699 ☐ 37 £700 to 999 ☐ 38 £1,000 to 1,499 ☐ 39
   £1,500 to 2,999 ☐ 40 £3,000 to 5,999 ☐ 41 £6,000 to 9,999 ☐ 42 over £10,000 ☐ 43

7. What regular use do you have for a micro?
   Accounting, pay, etc. ☐ 44 Stock, production control ☐ 45 Costing ☐ 46
   Business/financial planning ☐ 47 Engineering calculation ☐ 48 Science calculation ☐ 49
   Data collection ☐ 50 Self-education ☐ 51 Games ☐ 52 Other ☐ 53.
   If "other" please specify ....

8. Do you regularly use software package(s) that you did not write?
   Word/text processor ☐ 54 Database manager ☐ 55 Languages ☐ 56 Assembler ☐ 57
   Accounting, pay, etc. ☐ 58 Planning ☐ 59 Other ☐ 60
   If "other" please specify ....

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9. How much did you spend on software in the last 12 months?

Under £100 ☐ 61 £100 to 249 ☐ 62 £250 to 1,000 ☐ 63 over £1,000 ☐ 64

10. Which of the following types of article are important to your interest in *Practical Computing?*

News in brief ☐ 65 Hardware reviews ☐ 66 Software reviews ☐ 67 Applications ☐ 68
Programming techniques ☐ 69 Readers' letters ☐ 70 Readers' programs ☐ 71 Games ☐ 72 Education ☐ 73
Buyers' Guide (Software) ☐ 75 Buyers' Guide (Microcomputers) ☐ 76 Buyers' Guide (Peripherals) ☐ 77

11. How do you normally get your copy of *Practical Computing?*

Own subscription ☐ 78 Company subscription ☐ 79 Computer club ☐ 80 School friend ☐ 81
Buy at W H Smith or Menzies ☐ 82 Buy at another newsagent ☐ 74 Buy at computer shop ☐ 83

12. What publications do you read regularly for information on computers and related subjects?

Practical Computing ☐ 84 Your Computer ☐ 85 Personal Computer World ☐ 86 Computing Today ☐ 87
Microcomputer Printout ☐ 88 Computer and Video Games ☐ 89 Electronics and Computing ☐ 90 Windfall ☐ 91
Educational Computing ☐ 92 Interface ☐ 93 CBM User ☐ 94 Kilobaud ☐ 95 '80 Microcomputing ☐ 96
Wireless World ☐ 97 Electronics Today International ☐ 98 Electronics and Music Maker ☐ 99
Byte ☐ 100 Elektor ☐ 101 Computer Weekly ☐ 102 Computing ☐ 103 Computer Talk ☐ 104 Datalink ☐ 105
Informatics ☐ 106 Computerworld UK ☐ 107 Micro Forecast ☐ 108 Office Systems ☐ 109 Microdecision ☐ 110
Which Computer? ☐ 111 Computer Management ☐ 112 Data Processing ☐ 113 Systems International ☐ 114
New Scientist ☐ 115 Omni ☐ 116 Science Digest ☐ 117 Scientific American ☐ 118 Technology Week ☐ 119

13. Do you intend to buy a micro in the next six months?

Yes ☐ 120 No ☐ 121

If so, what will it be?

Pet ☐ 122 Apple ☐ 123 Tandy ☐ 124 CP/M ☐ 125 Acorn ☐ 126 ZX-80/81 ☐ 127 BBC ☐ 128
Vic-20 ☐ 129 Nascom ☐ 130 A 16-bit micro ☐ 131 Any other, please specify ....

15. Do you intend to buy peripherals in the next six months?

Yes ☐ 132 No ☐ 133

If so, will they be?

Cassette ☐ 134 Printer ☐ 135 Discs 5.25in. ☐ 136 Discs 8in. ☐ 137 Hard discs ☐ 138 Plotter ☐ 139
High-resolution graphics ☐ 140

16. What daily newspapers do you read regularly?

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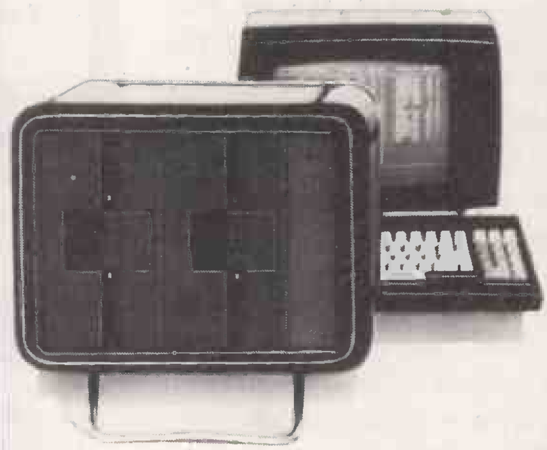

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Open File

This regular section of *Practical Computing* appears in the magazine each month, incorporating Tandy Forum, Apple Pie, ZX-80/81 Line-up and the other software interchange pages.

Open File is the part of the magazine written by you, the readers. All aspects of microcomputing are covered, from games to serious business and technical software, and we welcome contributions on CP/M, BBC Basic, Microsoft Basic, Apple Pascal and so on, as well as the established categories.

Each month the best contribution will be awarded £20; others receive £6. Send contributions to: Open File, *Practical Computing*, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Guidelines for contributors

Programs should be accompanied by documentation which explains to other readers what your program does and, if possible, how it does it. It helps if documentation is typed or printed with double-line spacing — cramped or handwritten material is liable to delay and error.

Program listings should, if at all possible, be printed out. Use a new ribbon in your printer, please, so that we can print directly from a photograph of the listing and avoid typesetting errors. If all you can provide is a typed or handwritten listing, please make it clear and unambiguous; graphics characters, in particular, should be explained.

We can accept material for the Pet, Vic and Sharp MZ-80K on cassette, and material for the larger machines can be sent on IBM-format 8in. floppy discs.

Real-time clock

MANY MICROPROCESSOR applications, such as data collection, security systems and some business uses, call for programs to know the time of day, notes Peter Keogh of Luton, Bedfordshire. The real-time clocks required for this purpose are usually expensive electronic accessories requiring an additional circuit board. For the Acorn Atom, however, it is possible to set up a real-time clock using one of the timers on the 6522 VIA chip. Since this chip is needed to operate the printer interface, the real-time clock facility is usually available.

The VIA is set to interrupt the 6502 CPU at regular intervals. Note that link 2 on the Atom circuit board must be connected to enable this modification. At each interrupt, a register is incremented and any carry-over goes into the adjacent series of registers. Examination of these registers gives an indication of lapsed time.

A problem arises because the registers must be examined one at a time. A significant error may be introduced if carry-over occurs at the wrong moment, though the clock will continue to run. To enable the registers to be interrogated reliably, the interrupt service routine itself must recognise when a time request exists and copy the registers to a second set which remains unaltered until the next time request. The program shows the different processes involved and how they interconnect.

The least-significant register, 84H, is incremented by eight, 32 times per second by the assembler-interrupt service routine. Carry-over is held in registers 83H to 80H which show integer seconds. The interrupt rate is controlled by the VIA timer one-count cycle, which here is set to 31,250 clock pulses. The subtraction of two in the program is to allow for the period between the end of one count cycle and the start of the next.

The interrupt rate will be precise if the Atom circuit-board crystal is running at

(continued on page 139)

DYNABYTE 5000. THE SYSTEM THAT GROWS WITH YOU

The Dynabyte 5000 from Metrotech is one of the most flexible and comprehensive Micro's available. It's smoothly upgradeable from a basic system with 630 thousand bytes storage to a powerful multi-processing, multi-user network with 99 million bytes.

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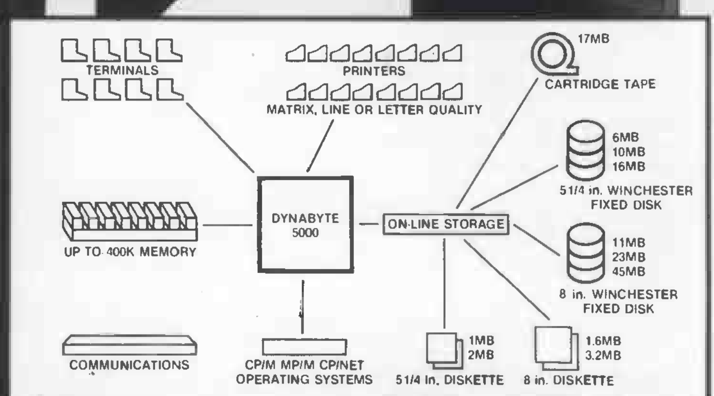
The Dynabyte system is distributed in the UK solely by Metrotech, Waterloo Road, Uxbridge, Middlesex UB8 2YW. Tel: 0895-58111 Ext. 265, 287, 247 & 269. Metrotech is a member of the Grand Metropolitan Group.



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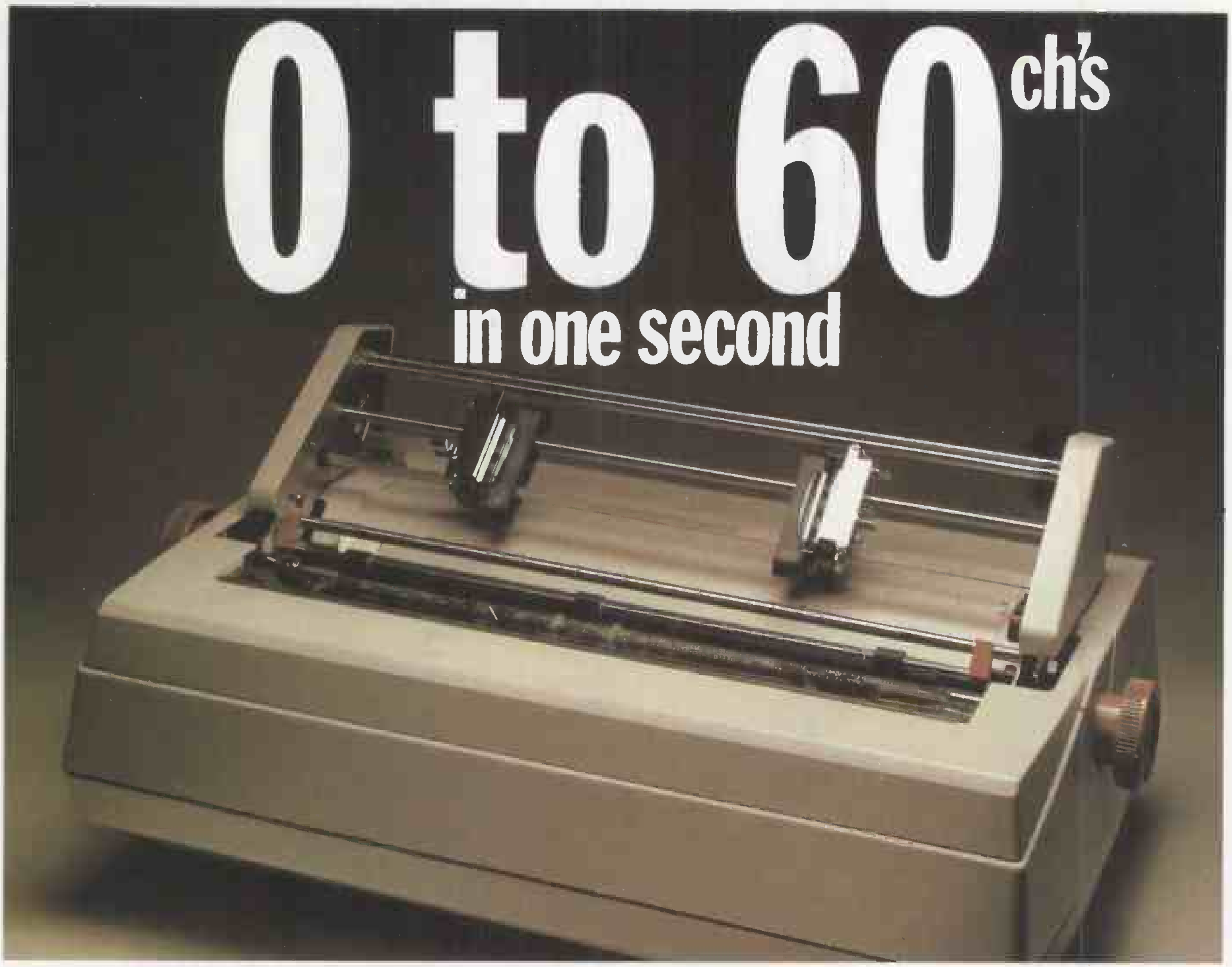

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The Ricoh 1600S is available only from Micropute and their authorised dealers, all backed up with a nation-wide service network. If you're interested in the 1600S either as a customer or as a dealer, send the coupon now.

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PRINT ELEMENT	DAISY-WHEEL	DAISY-WHEEL	THIMBLE	DOUBLE DAISY-WHEEL	DOUBLE DAISY-WHEEL
AUTO BIDIRECTIONAL	Yes	No	No	No	Yes
AUTO LOGIC SEEKING	Yes	No	Yes	No	Yes
PROPORTIONAL PRINT CAPABILITY	Yes	Yes	Yes	No	Yes
EXTENDED CHARACTER SET	No	No	Yes	Yes	Yes
LETTER QUALITY PRINT	Yes	Yes	Yes	Yes	Yes
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(continued from page 136)

exactly 1MHz — but some adjustment of the count size will normally be needed. In this program, a consistent accuracy of better than about one second per day can be achieved.

The subroutine at line 610 onwards is used to extract the time into the VV array, signalling a request for time by setting register 89H to one. It is reset by the interrupt service routine.

Use of the VIA timer keeps the time-keeping function quite independent of any program operations, unlike the use of Wait, and it can be adjusted to a wide range of time intervals very easily. Among some minor snags, the clock will be stopped by Break, since the interrupt-request disable flag in the CPU status register is reset. Tones are modified by the clock and acquire a distinct warble.

Surprisingly, tape transfers seem unaffected and it is possible, having set up the clock, to read in a further program from a cassette. Printer functions are unaffected too, and the CPU is slowed by a negligible 0.3 per cent. Note that the interrupt service routine has been optimised for speed.

Real-time clock.

```
 10 REM PM KEOGH 1981
100 DIM VV4
110 A=£2800;B=£B002;V=£B800
120 F=256;G=60
130 V?14=£7F
140 PRINT $21
150 GOSUB a;GOSUB a
160 PRINT $6
170 ?£204=A; ?£205=A/F; LINK VV4
180 K=31250-2
190 V?4=K
200 V?5=K/F
210 V?11=£40
220 V?14=£C0
230 REM timer routine--------
240 PRINT $12 ''"WHAT START TIME?"'
250 INPUT "HOURS"H
260 INPUT "MINS "M
270 H=(H*G+M)*G
280 PRINT ''"TAP Q TO START"''
290eIF ?£B001=£FF; GOTO e
300 ?£84=0
310 FOR I = 3 TO 0 STEP -1
320 I?£80=H%F;  H=H/F; NEXT
330 REM clear screen----------
340zCLEAR 0; ?£E1=0
350 K= -1
360sGOSUB c
370 IF !£85<=K; GOTO s
380 ?B=4;?B=0;  REM TICK
390 PRINT $30 '''VV2" HOURS"'VV1"
MINUTES"'VV0" SECONDS"
400 K=!£85
410 GOTO s
420aREM assembler-------------
430 P=A
440[
450 STX £8A
460 LDA £B804
470 LDX @4;LDA @8; CLC
480:VV0 ADC £80,X; STA £80,X
490 LDA @0
500 BCC VV1
510 DEX; BPL VV0
520:VV1 CMP £89;BEQ VV3
530 LDX @0; STX £89
540 STY £8B; LDY @3
550:VV2 LDA £80,X; STA £85,Y
560 INX; DEY; BPL VV2
570 LDY £8B
580:VV3 LDX £8A; PLA; RTI
590:VV4 CLI; RTS;]
600 RETURN
610cREM time extraction-------
620 ?£89=1
630dIF ?£89=1; GOTO d
640 C=!£85
650 VV0=C%G; C=C/G
660 VV1=C%G; VV2=C/G
670 RETURN
```

Monitor select

NO DOUBT other readers who have purchased new monitor chips for the Superboard find that some programs need to be rewritten because the new chip utilises previously unused page-two space, writes M J Bedford of Bradford, West Yorkshire. One way to overcome this problem, which is particularly relevant to some machine-code games is to fit both ROMs.

The different chip-select polarity requirements of the old ROM and the new EPROM, a. 2716, make it possible to use a simple DPDT for enabling either monitor. The old monitor chip requires the chip-select line to go high, whereas the replacement EPROM monitor requires the chip-select line to go low. The new monitor chip should be soldered piggy-back fashion to the original chip, apart from pins 18 and 20 which are bent out. Pin 18 should be tied to MCS at pad 7 and pin 20 is connected to the selector switch — see figure 1. Pin 21 should be tied to +5V. This method cannot be used for WEMON, which occupies a 4K block and thus has different fitting requirements.

Switching between monitors is not advised when a program has been loaded, as the system crashes rather badly. Basic 1 chips can also be piggy-backed in a similar fashion. I found, however, that only an SPDT was necessary in this case. The new Basic 1 is soldered piggy-back fashion on to the old Basic 1 chip, apart from pins 18, 20 and 21 which are bent out and connected as shown in figure 2.

This fitting method allows the Null command to be retained by those fortunate enough to have found a use for it. The chips can be selected at will by pressing the Break key, selecting the chip and then performing a warm start.

Monitor select — figure 1.

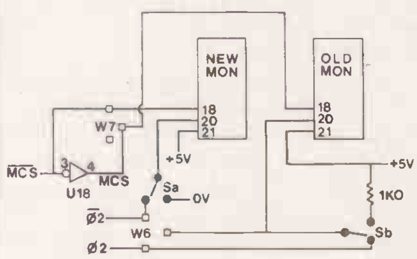
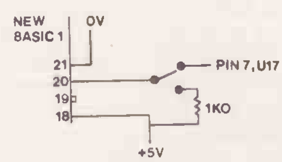


Figure 2.



I fitted both chips because the new Basic 1 would not load programs. This function had been displaced upwards one byte in the new chip and was not being found by the monitor. I now load programs using the old chip and then switch to the new chip for normal running because of the improved facilities it offers, e.g., understandable syntax error messages, Ctrl-Z gives a fast screen clear, etc.

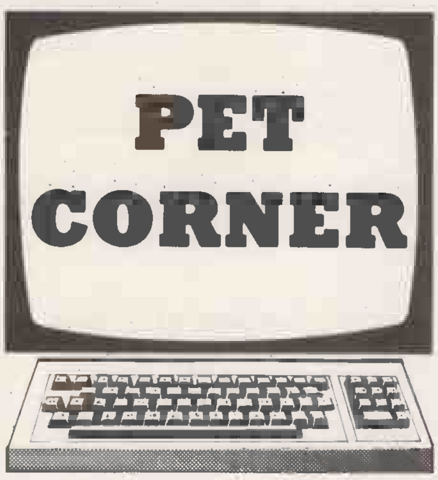
Scroll stopper.

```
10  REM SCROLL STOPPER FOR CEGMON UK101
12  REM ADAPTED FROM PRACTICAL COMPUTING
14  REM DECEMBER 1981
16  REM program should reside at location 660
18  REM (0294 hex) since the Control-C routine
20  REM is at FB94 hex, with its vector at
21  REM 541 (0217/8 hex).
22  REM Therefore: line 54 - 155 changed to 148
23  REM                      255 changed to 251
24  REM            line 56 - 667 changed to 660
26  :
28  REM To invoke POKE 541,2
30  REM To disable POKE 541,251
40  :
46  :
48  DATA 173,5,2,208,20,165,19,201,153
50  DATA 208,14,169,253,141,0,223,173,0
52  DATA 223,73,255,240,244,48,3,76
54  DATA 148,251,24,76,79,166
56  A=660:FOR N=0TO31:READ D:POKE A+N,D:NEXT
58  END
```

Scroll stopper

THIS SCROLL STOPPER program for UK 101 with Cegmon comes from J M Wilson of High Wycombe, Buckinghamshire. It is adapted from Derek Aston's program in the December 1981 edition of 6502 Special.

The program should reside at location 660 (0294 hex) since the Control-C routine is at FB94 hex. In line 54, 155 becomes 148, and 255 becomes 251. In line 56, 667 becomes 660. To invoke the routine Poke 541,2; to disable, Poke 541, 251.



Petvoice

WITHOUT satisfactory I/O capabilities, the applications to which even the most powerful computer may be put are severely limited, writes N J Bailey of Bristol. Most computers rely on a keyboard for input. Output is via a monitor, domestic television set and modulator, or printer.

The most flexible and user-friendly form of output is speech — humans use it all the time — but speech synthesis is currently very expensive and available only on a few systems. It was therefore decided to write a machine-code subroutine to store and, later, replay speech at will from any point in a program.

Possible methods of storing such information that were considered were:

- To attach a digital-to-analogue converter, DAC, to an eight-bit parallel port, sample the input waveform at regular intervals, and then store the values byte-by-byte in memory to be replaced via an analogue-to-digital converter, ADC, connected to the same port.
- To digitise the input signal into a stream of ones and zeros, read the resulting data bit by bit, and then replay the data in a similar fashion.

The first method has the advantage that the playback quality of the recorded speech is potentially very good, and the software easy to write. However, it has the disadvantages that it entails the construction of two relatively expensive units — the DAC and ADC. It would also use up available memory at eight times the rate of the second method.

The second method, on the other hand, is extremely economic with available memory and is relatively cheap and easy on the hardware side. The system was to be developed and used on a 32K Pet fitted with new-ROM Basic 2.0. This machine is fitted with a 6522 VIA chip, so the serial-parallel and parallel-serial conversion may be performed entirely by the machine's hardware using the CB2 pin on the user port in conjunction with on-chip eight-bit shift register, further lowering the software requirements.

This pin is frequently used by Pet users to generate music and sound effects inside Pet programs. Many users will therefore already have a soundbox — a small loudspeaker and amplifier — connected to this pin which may be used as the output device.

These two programs reside in the second cassette buffer of the system 033A to 03F9 hex, providing facilities for speech input and output as detailed. Since calls to the Basic ROM are made, the program as it stands will only run on Basic 2.0 machines. Details of conversion for old ROMs are given in table 1.

As it is essential that the analogue input voltage from the speech source be converted to a level of either +5V or 0V, the circuit in figure 1 was constructed. It was converted to the external loudspeaker output of a standard mono cassette recorder, on to which the speech was recorded. The output signal should be connected to the CB2 input on the Pet user port, and sufficient memory should be reserved for the storage of the speech. Two seconds will fit into each 1,000 bytes.

This may be done by lowering the top-of-Basic pointer in memory locations 52 and 53 — 134 and 135 for old ROMs.

The direct command SYS871, SA, EA may then be given, where SA is the start address and EA the end address. Speech input will then begin.

On pressing return, the cursor will disappear and the cassette should then be played. The data will be input from the cassette recorder into the specified memory locations at 4,000 bits per second.

Connecting the soundbox to CB2 and entering SYS909, SA, EA reverses the process.

Speech produced by this method is not of particularly high quality, and although vowel sounds are easily distinguished, it is recommended that the message is printed on the screen while the speech is being

Table 1: Equivalent old-ROM memory locations.

Hex	Dec	Usage	Old-ROM equivalent address
$Lines CB/CC	203/204	Program's temporary storage.	$EE/EF (238/9)
Lines $11/12	17/18	Returned integer from ROM sbr.	$08/09 (8/9)
Lines $CDF8	52728	ROM sbr. : confirm comma in text	$CE11 (52753)
Lines $CC8B	52363	ROM sbr. : evaluate expression	$CCA4 (52388)
Lines $D6D2	54994	ROM sbr. : convert FPACC to an integer	$D6D0 (54992)
Lines $E848	59464	Timer 2 latch of VIA	same for old ROMs
Lines $E84B	59467	Shift register control	same for old ROMs
Lines $E84D	59469	Interrupt flag register	same for old ROMs

Petvoice

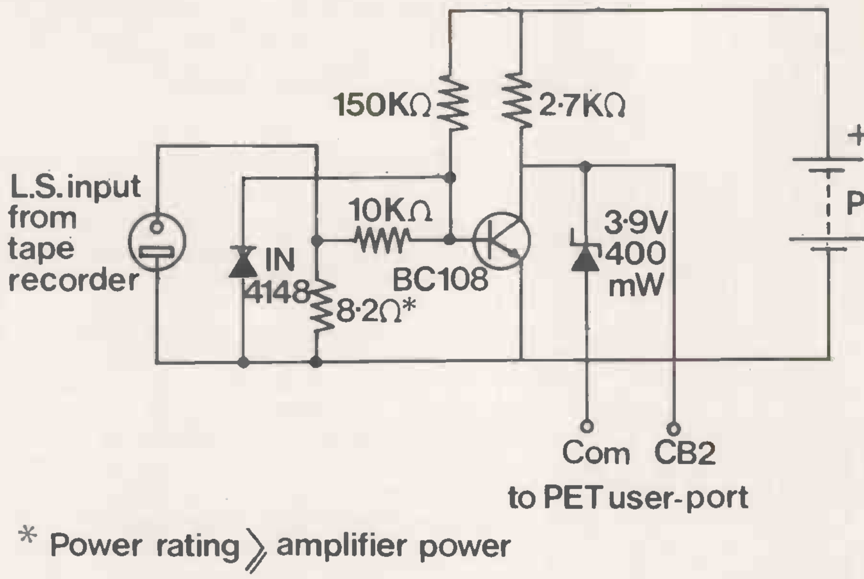
```
PETVOICE 1.0
B*
     PC  IRQ  SR AC XR YR SP
.,  7038 E62E 30 00 70 00 F6
.

.,  033A E6 CB     INC $CB
.,  033C D0 02     BNE $0340
.,  033E E6 CC     INC $CC
.,  0340 A5 CB     LDA $CB
.,  0342 C5 11     CMP $11
.,  0344 D0 04     BNE $034A
.,  0346 A5 CC     LDA $CC
.,  0348 C5 12     CMP $12
.,  034A 60        RTS
.,  034B 20 56 03  JSR $0356
.,  034E A5 11     LDA $11
.,  0350 85 CB     STA $CB
.,  0352 A5 12     LDA $12
.,  0354 85 CC     STA $CC
.,  0356 20 F8 CD  JSR $CDF8
.,  0359 20 8B CC  JSR $CC8B
.,  035C 4C D2 D6  JMP $D6D2
.,  035F AD 4D E8  LDA $E84D
.,  0362 29 04     AND #$04
.,  0364 F0 F9     BEQ $035F
.,  0366 60        RTS
.,  0367 20 4B 03  JSR $034B
.,  036A A0 00     LDY #$00
.,  036C 78        SEI
.,  036D A9 7D     LDA #$7D
.,  036F 8D 48 E8  STA $E848
.,  0372 AD 4B E8  LDA $E84B
.,  0375 29 E3     AND #$E3
.,  0377 09 04     ORA #$04
.,  0379 8D 4B E8  STA $E84B
.,  037C 20 3A 03  JSR $033A
.,  037F 08        PHP
.,  0380 20 5F 03  JSR $035F
.,  0383 AD 4A E8  LDA $E84A
.,  0386 91 CB     STA ($CB),Y
.,  0388 28        PLP
.,  0389 D0 E2     BNE $036D
.,  038B 58        CLI
.,  038C 60        RTS
.,  038D 20 4B 03  JSR $034B
.,  0390 A0 00     LDY #$00
.,  0392 78        SEI
.,  0393 A9 7D     LDA #$7D
.,  0395 8D 48 E8  STA $E848
.,  0398 AD 4B E8  LDA $E84B
.,  039B 29 E3     AND #$E3
.,  039D 09 14     ORA #$14
.,  039F 8D 4B E8  STA $E84B
.,  03A2 20 3A 03  JSR $033A
.,  03A5 08        PHP
.,  03A6 B1 CB     LDA ($CB),Y
.,  03A8 8D 4A E8  STA $E84A
.,  03AB 20 5F 03  JSR $035F
.,  03AE 28        PLP
.,  03AF D0 E2     BNE $0393
.,  03B1 58        CLI
.,  03B2 AD 4B E8  LDA $E84B
.,  03B5 29 E3     AND #$E3
.,  03B7 8D 4B E8  STA $E84B
.,  03BA 60        RTS
.,  03BB 00        BRK
.?
.
READY.
```

Figure 1.

Semiconductors:
- BC108 transistor
- 1N4148 silicon diode or equiv.
- 3.9V, 400mW Zener diode

Resistors:
- 8.2 Ω (value to suit source)
- 10 kΩ 0.25W
- 150 kΩ 0.25W
- 2.7 kΩ 0.25W

Miscellaneous:
- Matrix board
- Connector to suit Pet user port
- Connector to suit source
- PP3 battery and connector
- Wire, solder, etc.



output. The values of SA and EA may be variables, constants or expressions, so SYS909, 1000★SQR(144), 10000★SIN(0.3) for instance is perfectly allowable.

The program may be divided into six parts.

$033A — $034A increments a two-byte pointer stored in $11/12 (low/high).
$034B — $0355 evaluates the start address.
$0356 — $035E evaluates the end address.
$035F — $0366 waits until eight bits have been shifted in or out by the 6522 VIA.
The remaining two subroutines.
$0367 — $038C and $038D — $03BA perform data input and output respectively.

The input and output routines are similar in operation: the "from" and "to" addresses are evaluated in zero page; the interrupt is disabled to prevent any interference with the routines; the appropriate VIA registers are set up and data transfer begins. The PHP instruction after the JSR $033A remembers whether the subroutine should be terminated until after the last byte has been transferred.

```
HEX DUMP

B*
    PC  IRQ  SR AC XR YR SP
.;  7038 E62E 30 00 70 00 F4
.
.:  033A E6 CB D0 02 E6 CC A5 CB
.:  0342 C5 11 D0 04 A5 CC C5 12
.:  034A 60 20 56 03 A5 11 85 CB
.:  0352 A5 12 85 CC 20 F8 CD 20
.:  035A 8B CC 4C D2 D6 AD 4D E8
.:  0362 29 04 F0 F9 60 20 4B 03
.:  036A A0 00 78 A9 7D 8D 48 E8
.:  0372 AD 4B E8 29 E3 09 04 8D
.:  037A 4B E8 20 3A 03 08 20 5F
.:  0382 03 AD 4A E8 91 CB 28 D0
.:  038A E2 58 60 20 4B 03 A0 00
.:  0392 78 A9 7D 8D 48 E8 AD 4B
.:  039A E8 29 E3 09 14 8D 4B E8
.:  03A2 20 3A 03 08 B1 CB 8D 4A
.:  03AA E8 20 5F 03 28 D0 E2 58
.:  03B2 AD 4B E8 29 E3 8D 4B E8
.:  03BA 60 00 00 00 00 00 FE FF
.?
.
READY.
```

In use, the voice may be input and then manually compacted. After entering the monitor and observing a hex dump of the area of memory involved, the bytes containing no information will be seen to contain Hex FF. Re-entering Basic, the block of memory containing useful data may be moved down so as to "butt up" against the next piece of useful data thus:

FORI = [start of useful data] TO [end] : POKE I–N, PEEK(I) :POKEI,255 : NEXT

where N is the number of unused bytes. In this way all the available space may be utilised, realising a storage capacity of two seconds per K.

With a cassette system, the generated vocabulary is best saved in a program file by the monitor before the program which is to use it. Then enter the following sequence of direct commands:

LOAD '[name of vocab file]'
NEW
LOAD '[name of main program]'
RUN

The first line of the Basic program should lower the top-of-Basic pointer as previously described, and then immediately CLR all variables. This will ensure that all the other Basic pointers are reinitialised. This line should make no reference to any variables.

If a disc drive is available, the vocabulary program file may be read by opening the file and assigning a secondary address of zero. After ignoring the first two characters by using Get# twice so as to miss the start address, Get# may then be used repeatedly. Poking the ASCII value of the resulting string into memory until an end-of-file, ST=64, is detected. Using this system, vocabulary may be passed from disc to reserved memory.

If you have a Pet fitted with a different version of Basic, of another machine fitted with a 6522 VIA device, details of the Pet memory are shown in the table.

Screen printing

ON UPGRADING to CBM Basic 4.0 from Basic 3 I found the Screen Print routine — Pet Corner, June 1981 — would no longer work, writes M J Valentine of Rotherham, South Yorkshire. Close inspection via the Pet monitor revealed that yet again, on upgrading, that there had been a major reorganization of firmware. After many hours of searching I found the corresponding entry points to Basic 3, and was then able to modify the program accordingly.

The upgraded screen print will work on CBM Basic 4, 40-column machines.

Screen printing

```
1 POKE59468,12:POKE59468,14:POKE59468,12:PRINT"4032- 4022 SCREEN PRINT
2 PRINT"HIT ANY KEY WHEN 4022 ON & LOADED
3 PRINT"ORIGINALLY BY JOHNANTHEN DICK
4 PRINT"PRACTICAL COMPUTING (C) OCTOBER 1980
5 PRINT"MODIFIED M VALENTINE NOVEMBER 1981
6 GETQ$:IFQ$=""THEN6
7 PRINT"4022 SCREEN PRINT LOAD IN PROGRESS"
8 POKE53,(PEEK(53)-1):S=PEEK(53)*256:GOSUB17
9 PRINT"ROUTINE CALL          SYS0"
10 PRINT"ROUTINE DISABLE       POKE 0,96
11 PRINT"ROUTINE ENABLE        POKE 0,76
12 PRINT"LINE SPACE(SA=6)      POKE"S+66",24"
13 PRINT"GRAPHICS MODE         POKE 59468 ,12"
14 PRINT"LOWER CASE MODE       POKE 59468 ,14"
15 SYSS:NEW
16 A$="@0:4022SCRTOP":SAVEA$,8:SAVEA$,8:VERIFYA$,8
17 FORI=STOS+256:READA$:C=LEN(A$):IFA$="*"THENRETURN
18 A=ASC(A$)-48:B=ASC(RIGHT$(A$,1))-48
19 N=B+7*(B>9)-(C=2)*(16*(A+7*(A>9)))
20 IFA$="SS"THENN=(S/256)
21 IFA$="XX"THENN=PEEK(53)
22 POKEI,N:NEXT:RETURN
23 PRINT"BYTE"L"=["A$"] ???"
24 CLR:POKE53,(PEEK(53)+1)
```

(listing continued on next page)

(listing continued from previous page)

```
25 DATAA5,35,85,02,A9,00,85,01
26 DATA20,18,XX,20,30,XX,EA,EA
27 DATA20,18,XX,60,EA,EA,EA,EA
28 DATAA9,04,20,E2,F2,A9,06,20
29 DATAE2,F2,A5,35,85,02,60,EA
30 DATAEA,EA,EA,EA,EA,EA,EA,EA
31 DATAEA,EA,EA,EA,EA,EA,EA,EA
32 DATAEA,EA
33 DATAA9,06,A2,06,20,E5,XX,A9
34 DATA18,20,46,BB,20,A6,F2,A9
35 DATA04,A2,00,20,E5,XX,A9,00
36 DATA85,01,A9,80,85,02,A0,00
37 DATAA2,00,AD,4C,E8,C9,0C,F0
38 DATA05,A9,11,20,46,BB,18,B1
39 DATA01,C9,1F,B0,05,69,40,4C
40 DATAAC,XX,C9,80,90,09,C9,BF
41 DATAB0,05,E9,3F,4C,B6,XX,C9
42 DATAC0,90,07,C9,DF,B0,03,4C
43 DATAB6,XX,C9,E0,90,05,E9,40
44 DATA4C,B6,XX,C9,40,90,09,C9
45 DATA60,B0,05,69,80,4C,AC,XX
46 DATAC9,61,90,06,C9,7F,B0,02
47 DATA69,40,85,0F,A9,92,20,46
48 DATABB,4C,BD,XX,85,0F,A9,12
49 DATA20,46,BB,A5,0F,20,46,BB
50 DATAC8,D0,02,E6,02,E8,E0,28
51 DATAD0,9C,20,DF,BA,A2,00,A5
52 DATA02,C9,83,F0,03,4C,5C,XX
53 DATAC0,E8,F0,03,4C,5C,XX,20
54 DATAA6,F2,60,85,D2,86,D3,A9
55 DATA00,85,D1,A9,04,85,D4,20
56 DATA63,F5,A6,D2,20,FE,F7,60
57 DATA*,00,00,00,00,00,00,00
```

Stress calculation

SIMPLE BENDING THEORY for structural components leads to the formula:

$$\frac{Q}{y} = \frac{M}{I}$$

writes A L Milnes of Portsmouth, Hampshire. Q is the stress existing in the component at a distance y from the neutral axis when the component is subjected to a bending moment of M; I represents the second moment of area of the cross-section of the component about an axis through the centroid of the section — the neutral axis — the axis being perpendicular to the plane of the bending moment.

This short program calculates the position of the neutral axis relative to the base of the section, and the second moment of area of the section about this axis. The program assumes that the web and flanges can be approximated with sufficient accuracy by rectangles. In actual sections, there are fillets at the junction of the flanges to the web, and the toes of the flanges are radiused. In addition, the flanges are tapered if the section has been produced by a rolling process, but these approximations are not significant in many practical situations. The program is quite useful for simple sections which can be considered to be made up of three rectangles.

Machine-code sort

THE MACHINE-CODE sort routine described by Simon Letts in Pet Corner, May 1981, has proved useful to Mervyn Broadway of Slough, Berkshire. Usually he needs to search an array for a match of two strings, but since the sort routine is limited to 256 bytes it is far quicker to search through an array in its unsorted format at machine-code speed.

This routine is used in much the same way as Letts' sort routine. The string to be matched is entered into the zero element of the array to be searched. Consequently the array must start from element 1. The length of the array is Poked into 180, and the array is set equal to itself. Finally SYS634 completes the operation.

The matched output — in the form of the array element numbers that matched — are displayed in Pet screen-code format on the screen top left. This is for display only. Setting the top of memory, however, allows the area $7F00 onwards to be used, and leaves the screen free to be used in any way. If the screen is scrolled while the information is displayed, then the information is lost.

Finally, the arrays may be found by Peeking their locations until a zero is found, for example

PRINT A$(PEEK(32768))

The zero indicates the end of the matches; a zero by itself indicates that no matches have been found.

The line-clearing routine is useful if you have to overprint a line but do not want any of the previous line left on the screen if the new line is shorter than the old one. Its syntax is

PRINT A$;: SYS900

Line-clearing routine.

```
.,  0384 08        PHP
.,  0385 48        PHA
.,  0386 8A        TXA
.,  0387 48        PHA
.,  0388 98        TYA
.,  0389 48        PHA
.,  038A A9 20     LDA #$20
.,  038C A4 C6     LDY $C6
.,  038E 91 C4     STA ($C4),Y
.,  0390 C8        INY
.,  0391 C0 28     CPY #$28
.,  0393 D0 F9     BNE $038E
.,  0395 68        PLA
.,  0396 A8        TAY
.,  0397 68        PLA
.,  0398 AA        TAX
.,  0399 68        PLA
.,  039A 28        PLP
.,  039B 60        RTS
```

Machine-code sort routine.

```
.,  027A 08        PHP
.,  027B 48        PHA
.,  027C 8A        TXA
.,  027D 48        PHA
.,  027E 98        TYA
.,  027F 48        PHA
.,  0280 D8        CLD
.,  0281 A5 44     LDA $44
.,  0283 85 B7     STA $B7
.,  0285 A5 45     LDA $45
.,  0287 85 B8     STA $B8
.,  0289 A2 01     LDX #$01
.,  028B A9 00     LDA #$00
.,  028D 8D 00 80  STA $8000
.,  0290 85 B5     STA $B5
.,  0292 A0 02     LDY #$02
.,  0294 B1 B7     LDA ($B7),Y
.,  0296 99 BB 00  STA $00BB,Y
.,  0299 88        DEY
.,  029A 10 F8     BPL $0294
.,  029C 18        CLC
.,  029D A5 B7     LDA $B7
.?

.,  029F 69 03     ADC #$03
.,  02A1 85 B7     STA $B7
.,  02A3 A5 B8     LDA $B8
.,  02A5 69 00     ADC #$00
.,  02A7 85 B8     STA $B8
.,  02A9 A0 02     LDY #$02
.,  02AB B1 B7     LDA ($B7),Y
.,  02AD 99 BE 00  STA $00BE,Y
.,  02B0 88        DEY
.,  02B1 10 F8     BPL $02AB
.,  02B3 A5 BE     LDA $BE
.,  02B5 F0 0B     BEQ $02C2
.,  02B7 C8        INY
.,  02B8 C4 BB     CPY $BB
.,  02BA F0 12     BEQ $02CE
.,  02BC B1 BF     LDA ($BF),Y
.,  02BE D1 BC     CMP ($BC),Y
.,  02C0 F0 F5     BEQ $02B7
.,  02C2 E8        INX
.,  02C3 E4 B4     CPX $B4
.,  02C5 D0 D5     BNE $029C
.,  02C7 68        PLA
.?

.,  02C8 A8        TAY
.,  02C9 68        PLA
.,  02CA AA        TAX
.,  02CB 68        PLA
.,  02CC 28        PLP
.,  02CD 60        RTS
.,  02CE A4 B5     LDY $B5
.,  02D0 8A        TXA
.,  02D1 99 00 80  STA $8000,Y
.,  02D4 C8        INY
.,  02D5 84 B5     STY $B5
.,  02D7 A9 00     LDA #$00
.,  02D9 99 00 80  STA $8000,Y
.,  02DC 4C C2 02  JMP $02C2
```

Stress calculation.

```
100 PRINT"□"
110 PRINT"SECOND MOMENT OF AREA OF A SECTION "
120 PRINT"              \/"
130 PRINT" ------>▓▓▓▓▓▓▓▓▓▓▓<---- A(1)"
140 PRINT"             /\ * /\             "
150 PRINT"              I *  I             "
160 PRINT"           B(1)*  I             "
170 PRINT"          ---->*<------  A(2) "
180 PRINT"                *  I             "
190 PRINT"             I  *B(2)            "
200 PRINT"             I  *  I             "
210 PRINT"             \/ * \/             "
220 PRINT"  --->▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓<---A(3)"
230 PRINT"             /\                  "
240 PRINT"              I                  "
250 PRINT"           B(3)                  "
260 PRINT
270 INPUT"TYPE A(1),A(2),A(3)";A(1),A(2),A(3)
280 INPUT"TYPE B(1),B(2),B(3)";B(1),B(2),B(3)
290 REM FIRST CALCULATE THE AREA OF THE SECTION
300 LET AR=A(1)*B(1)+A(2)*B(2)+A(3)*B(3)
310 REM NOW CALCULATE THE FIRST MOMENT ABOUT THE BASE
320 LET M1=A(1)*B(1)*(B(3)+B(2)+.5*B(1))
330 LET M1=M1+A(2)*B(2)*(B(3)+.5*B(2))
340 LET M1=M1+A(3)*B(3)*(.5*B(3))
350 REM CALCULATE THE DISTANCE OF THE CENTROID ABOVE THE BASE
360 LET YB=M1/AR
370 REM NOW THE SECOND MOMENT ABOUT THE BASE
380 LET M2=(A(1)*B(1))*((B(3)+B(2)+.5*B(1))↑2)+((A(1)*(B(1)↑3))/12)
390 LET M2=M2+(A(2)*B(2)*((B(3)+.5*B(2))↑2)+(A(2)*((B(2)↑3)/12)))
400 LET M2=M2+((A(3)*(B(3)↑3))/3)
410 REM M2 NOW HOLDS SECOND MOMENT OF SECTION ABOUT THE BASE
420 REM CALCULATE SECOND OF SECTION ABOUT AN AXIS PARALLEL TO BASE THROUGH
430 REM THE CENTROID OF THE SECTION
440 LET MI=M2-(YB*YB*AR)
450 REM NOW OUTPUT THE RESULTS
460 PRINT
470 PRINT"AREA OF SECTION=",AR
480 PRINT
490 PRINT"CENTROID OF SECTION ABOVE THE BASE=,"YB
500 PRINT
510 PRINT"SECOND MOMENT OF THE SECTION ABOUT THE BASE=",M2
520 PRINT
530 PRINT"SECOND MOMENT OF THE SECTION ABOUT AN AXIS THROUGH THE CENTROID AND";
540 PRINT" PARALLEL TO THE BASE=",MI
550 PRINT:PRINT
560 PRINT"YOUR DATA WAS A(1)="A(1)"A(2)"A(2);
570 PRINT"A(3)"A(3)"AND B(1)"B(1)"B(2)"B(2)"B(3)"B(3)
```

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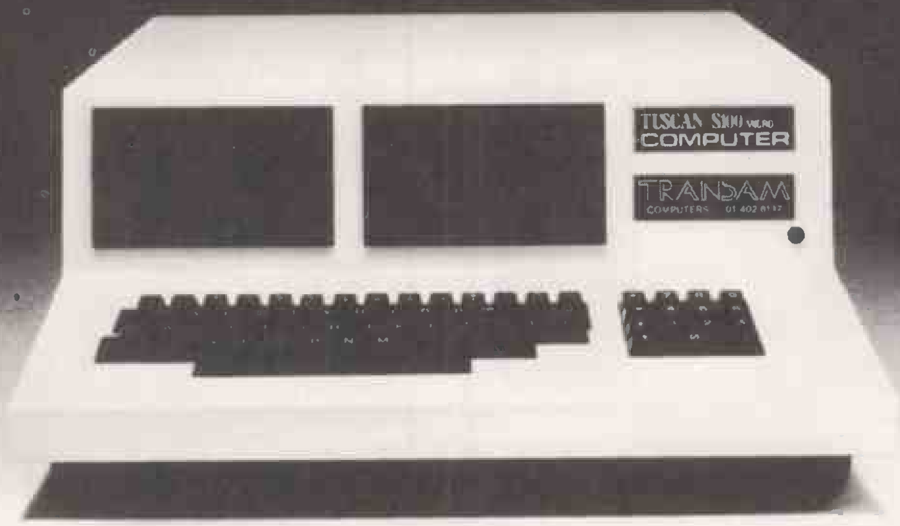

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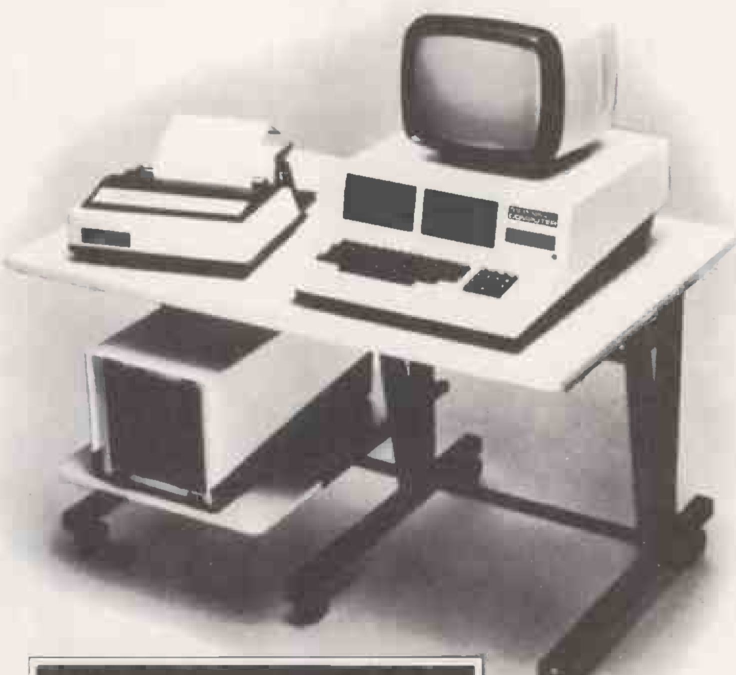

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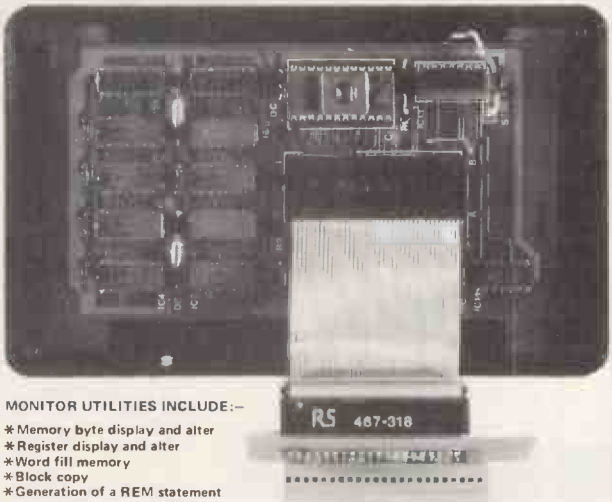

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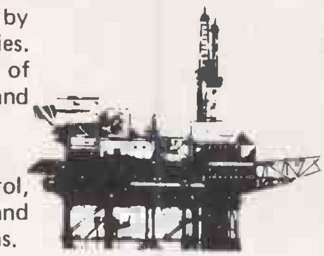

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Zombies

THIS GAME by Richard Hooper of Gerrards Cross, Buckinghamshire occupies about 2K of memory on the ZX-81. When it is run, a pot-hole, represented by a black square, appears in the middle of the screen. Five randomly-placed zombies represented by grey squares, and a randomly-placed player, represented by an O also appear.

The Zombies immediately start moving towards you, and will follow you round the screen. By pressing 5, 6, 7 or 8 you can move in the direction of the arrow on the key. If one of the Zombies catches you, the program stops and your only chance to escape is to lure it into the pot-hole.

When all of the Zombies have fallen down the hole a congratulatory message appears at the top of the screen. The Zombies only move at half your own speed, so it is possible to outrun one on its own. You are in danger of being caught if you become trapped between two or more Zombies.

The arrays X and Y contain the co-ordinates of the Zombies and the player, whose co-ordinates are stored in X(6) and Y(6). The array Z is used to find out whether a Zombie is active or not, i.e., whether it has fallen down the pot-hole. Lines 40 to 70 generate the positions of the Zombies and the player. Lines 80 to 120 print the Zombies and the pot-hole on the screen.

Lines 130 to 180 test whether a Zombie has fallen down the pot-hole or whether one has caught you, and also move them all towards you. Lines 190 to 250 move the player and check that you are still on the screen. Then the screen is cleared and the program returns to line 80.

If a Zombie falls down the pot-hole, the program goes to line 280 and the Zombie concerned is rendered inactive. The subroutine also checks whether any Zombies remain.

To make the game harder you could have more Zombies or make them move at the same speed as the player, by taking away the "/2" from the end of lines 160 and 170. To stop the game if the player steps into the pot-hole, add

185 IF X(6) = 10 AND Y (6) = 15 THEN STOP

The program is quite slow, but fun and addictive.

Zombies.

```
10   DIM X(6)
20   DIM Y(6)
30   DIM Z(5)
40   FOR I=1 TO 6
50   LET X(I)=INT (22*RND)
60   LET Y(I)=INT(32*RND)
70   NEXT I
80   PRINT AT 10,15;CHR$ 128
90   PRINT AT X(6),Y(6);"0"
100  FOR I=1 TO 5
110  IF Z(I)=0 THEN PRINT AT X(I),Y(I);CHR$ 8
120  NEXT I
130  FOR I=1 TO 5
140  IF X(I)=10 AND Y(I)=15 THEN GOSUB 280
150  IF Z(I)=0 AND X(I)=X(6) AND Y(I)=Y(6) THEN GOTO 320
160  LET X(I)=X(I)+SGN(X(6)-X(I))/2
170  LET Y(I)=Y(I)+SGN(Y(6)-Y(I))/2
180  NEXT I
190  LET A$=INKEY$
200  IF A$="5" THEN LET Y(6)=Y(6)-1
210  IF A$="6" THEN LET X(6)=X(6)+1
220  IF A$="7" THEN LET X(6)=X(6)-1
230  IF A$="8" THEN LET Y(6)=Y(6)+1
240  IF X(6)=-1 OR X(6)=22 THEN LET X(6)=X(6)+SGN(10-X(6))
250  IF Y(6)=-1 OR Y(6)=32 THEN LET Y(6)=Y(6)+SGN(15-Y(6))
260  CLS
270  GOTO 80
280  LET Z(I)=1
290  IF Z(1)*Z(2)*Z(3)*Z(4)*Z(5)=0 THEN RETURN
300  PRINT AT 0,0;"WELL DONE."
310  STOP
320  PRINT AT 0,0;"THEY GOT YOU."
```

Renumber routine

THIS RENUMBER program from Mangul Singh of Slough, Berkshire will fit into 1K on ZX-81. It also runs on the ZX-80 with new, 8K ROM. It will provide new line numbers for your programs in steps of 10.

You can increase or decrease the size of the steps by changing line 9080 to

LET B = B +N

where N is the size of the step required. The new line numbers will start at 10; if you wish to start at a different line number, alter line 0910 accordingly.

Renumber routine.

```
9000    LET     A=16509
9010    LET     B=10
9020    POKE    A,INT(B/256)
9030    POKE    A+1,B-(INT(B/256))*256
9040    LET     A=A+1
9050    IF      PEEK (A)=118 THEN GOTO 9070
9060    GOTO    9040
9070    LET     A=A+1
9080    LET     B=B+10
9090    IF      NOT PEEK(A)*256+PEEK(A+1)=9000 THEN GOTO 9020
9100    LIST.
```

Substitute operator.

```
10  CLS
20  PRINT"ENTER A NUMBER TO BE
    COMPARED WITH TWO"
30  INPUT A
40  IF A - 2 THEN GOTO 70
50  PRINT" EQUAL"
60  STOP
70  PRINT" NOT EQUAL"
80  GOTO 10
```

Substitute operator

THE ABSENCE of a "not equal to" logical operator is a major source of disappointment in the ZX-80, writes Michael Taylor of Bishop's Stortford, Hertfordshire. I have noticed, though, that a minus sign will do the job.

40 IF NOT A = 12 THEN GOTO 150

has the same effect as

40 IF A − 12 THEN GOTO 150.

Sinclair Basic appears to assume "is not equal to zero" after any If-Then statement with no comparator and second expression. So if A−12 is not equal to zero, then A cannot be zero. This sample program demonstrates:

Operating tips

MAY I pass on a few hard-won practical tips to other ZX-80/81 users, especially those who have added the 16K RAM pack, offers A H Davies of Coventry. After prolonged use — whether intermittant over a period of several months or in a long, single operating session — my ZX-80+16K seems to get bored or tired and develops some bad habits.

The most annoying of these is a pro-

(continued on next page)

Logic puzzle.

```
10  DIM A(9)
20  FOR X = 1 TO 9
30  LET A(X) = 0
40  NEXT X
50  LET A(5) = -37
60  FOR X = 1 TO 9
70  IF X = 5 THEN GOTO 130
80  LET P = RND(8)
90  FOR Y = 1 TO 9
100 IF A(Y) = P THEN GOTO 80
110 NEXT Y
120 LET A(X) = P
130 NEXT X
200 FOR X = 1 TO 3
210 FOR Y = 1 TO 3
220 PRINT CHR$( A( Y + (X -1)*3 ) +37);" ";
240 NEXT Y
250 IF X = 1 THEN PRINT "   123"
260 IF X = 2 THEN PRINT "   456"
270 IF X = 3 THEN PRINT "   789"
280 PRINT
290 NEXT X
300 PRINT
310 PRINT "FROM ";
320 INPUT F
330 PRINT F
340 IF F> 9 THEN GOTO 310
350 PRINT
360 PRINT "TO ";
370 INPUT T
380 PRINT T
390 IF T> 9 THEN GOTO 360
400 IF NOT A(T) =-37 THEN GOTO 360
410 IF ABS(F - T)=1 OR ABS(F - T) =3 THEN GOTO 430
420 GOTO 310
430 LET A(T) = A(F)
440 LET A(F) = -37
450 CLS
460 GOTO 200
```

(continued from previous page)

pensity to drop lines from the program without apparent cause or warning. It is also inclined to input lines with one digit of the number omitted so that they are shunted off into quite different parts of the program. I have found that the best way to deal with this is to write line numbers in blocks, giving one block only odd numbers, and the next block even numbers. Misplaced lines then stand out more readily.

An off-putting quirk it has developed on Load concatenates lines into a continuous single line, e.g.

100FORI=1TON110PRINT120NEXTI

which can produce some very unnerving printouts. Sometimes it just leaves lines out. I have been able to cure these errors by always keying in New after switching on and before keying in Load.

One of the program-writing problems that eluded me for a long time was what to do with that irritating 5/n error message while inputting instructions or outputting long strings of answers. A simple subroutine solves the problem:

```
9000 LET A = PEEK(16421)
9010 LET B = A - 2
9020 FOR C = 1 TO B
9030 PRINT
9040 NEXT C
9050 PRINT "PRESS NEWLINE TO
     CONTINUE"
9060 INPUT A$
9070 IF A$ = " " THEN GO TO 9080
9075 IF A$ = "9" THEN GO TO 9999
9080 CLS
9090 RETURN
9999 STOP
```

The subroutine is called by a Gosub 9000 at the end of the "page" of material, which should be limited to a maximum of 18 or 19 lines of printout. The Peek establishes the last line printed, reading from the bottom upwards, and so B tells you how many blank lines you have to fill to the penultimate line of the page of 22 lines. Line 9020 to 9040 then Print spaces to fill up any difference.

Once you press Newline the nil-string (9070) moves you on to CLS and then back into the main program and the next "page" of printout. Line 9075 enables you to climb out of a long series of pages and quickly return to List for debugging or simply to change a spelling mistake.

Logic puzzle

AN ARTICLE in 6502 Special, May 1981, prompted me to write a simple program for the ZX-80, explains E Mullinger of Windsor, Berkshire. The game represents the little squares in a frame that are shuffled around until they are in a logical order. This version has nine "squares" labelled with alpha characters, though the number can be increased simply by changing the size of the array and its accompanying subscripts.

Lines 10 to 130 set up the array with the central square blank and the others labelled A to H. Lines 200 to 300 display the values of the subscripts as alpha characters and print a square containing the relative location of the array subscripts used to move a "square" into the blank space. Lines 300 to 420 accept the move locations, and validate them to allow a move to be made only into a blank space; horizontal and vertical moves only are allowed.

The program does not prevent invalid moves from 4 to 3 and from 7 to 6, which you could try.

Message display

IT IS OFTEN necessary to reserve one line of the screen for comment, instructions, scores, etc., while leaving the upper part undisturbed, notes D M Bennion of Newcastle, Staffordshire. When a shorter message overwrites a longer one, spaces must be included to obliterate the old message completely.

This can be tedious and time-consuming, especially when an extra message is inserted during program development and all extra spaces must be adjusted accordingly. This short machine-code routine, which may be Poked into an initial Rem of 22 characters, and called by

RAND USR 16514

will clear the screen from the current Print position to the end of screen, and so remove all characters after a particular print statement.

A typical use could be as follows:

```
500 PRINT AT 12,0; "SORRY, THAT
    SQUARE IS FULL."
510 PRINT "PLEASE RE-ENTER YOUR
    MOVE."
```

followed by:

```
600 PRINT AT 12,0; "YOU GAIN ONE
    PIECE."
605 RAND USR 16514
```

which will remove all traces of the two previous lines.

Garrulous Godfrey

FANS OF *The Hitch-Hiker's Guide to the Galaxy* will remember Eddie, the friendly shipboard computer on the Heart of Gold. This program from Tim Johns provides you with all the worst aspects of Eddie's maddeningly incessant chatter, passing randomly-composed greetings of appropriate fatuity from one side of the TV screen to the other.

A short program first loads the two arrays:

```
10 DIM D$ (9,8)
20 DIM E$ (9,8)
30 FOR N =1 TO 9
40 INPUT D$(N)
50 PRINT N; " "; D$(N)
60 NEXT N
```

Message display.

LD B, (IY+58)	253,70,58	Lines to bottom of screen
DEC B	5	
DEC B	5	Allow for the two bottom lines
LD HL,(16398)	42,14,64	Get current print position
DEC HL	43	
INC HL	35	Move on
LD A, (HL)	126	
CP 118	254,118	Check for end of line
JRZ 4	40,4	
LD(HL),0	36,0	Print a space
JR 246	24,246	Move on
DJNZ 244	16,244	Start new line
RET	201	

After running the loading programs, type in the following, taking care of the leading spaces necessary to maintain the justified right-hand margin:

```
        "HI THERE"
         "SO LONG"
         "EVENING"
        "HAVE FUN"
           "HULLO"
       "CHEERIOH"
         "COOL IT"
        "BONJOUR"
           "ADIOS"
```

Next Edit lines 40 and 50, substituting E for D, then type in Goto 30 as a direct command and enter the following words, which are left-justified:

```
"EVERYONE"
"FRIENDS"
"GORGEOUS"
"GIRLS"
"SAILOR"
"CHEEKY"
"HANDSOME"
"MON AMI"
"AMIGOS"
```

Lastly type in the main program — which will overwrite the array-loading program — and store it. To start the program type Goto 10 as a direct command. You can experiment with the program, for example by arranging that the chatter passing from left to right on the screen has a different "personality" from the chatter passing from right to left.

Garrulous Godfrey.

```
10  RAND
20  LET A$=" "+D$(INT(RND*9)+1)
    +" "+E$(INT(RND*9)+1)+" "
30  LET R=INT(RND*2)
40  FOR N=1 TO R+50
50  LET A=(31-N AND R)+(N-19 OR R)
60  IF A<0 THEN LET A=0
70  LET B=(N-32 AND R)+(20-N OR R)
80  IF B<1 THEN LET B=1
90  LET C=(N-1 AND R)+(51-N OR R)
100 IF C>19 THEN LET C=19
110 PRINT AT 11,A; A$(B TO C)
120 NEXT N
130 GOTO 20
```

Digital exercise

THE OBJECT of this game for 1K ZX-81 is to place the cursor over as many random points as you can in the set time, writes David Clifton of Doncaster, South Yorkshire. You move by pressing 5, 6, 7 and 8 to move left, down, up and right respectively. To start, you set the number of seconds you wish the game to last and press New Line. When your time is up, your time and score are displayed on the screen.

Digital exercise.

```
10  INPUT K
20  LET J = K * 6
30  LET B = 0
40  LET Q = 1
50  LET N = Q
60  LET Z = INT(RND*60)
70  LET X = INT(RND*40)
80  LET C = 30
90  LET V = 20
100 PLOT C,V
110 LET N = N+Q
120 PLOT Z, X
130 IF INKEY$ = "5" THEN LET C = C-Q
140 IF INKEY$ = "6" THEN LET V = V-Q
150 IF INKEY$ = "8" THEN LET C = C+Q
160 IF INKEY$ = "7" THEN LET V = V+Q
170 IF N = J THEN GOTO 230
180 IF Z = C AND V = X THEN GOTO 210
190 CLS
200 GOTO 100
210 LET B = B+Q
220 GOTO 60
230 PRINT AT 1,1;"YOU HAVE SCORED";
    B;" IN ";K;" SECONDS "
240 STOP
```

Fuel economy

THIS PROGRAM by John Gent of Crook, County Durham runs on a 16K ZX-80 with 8K ROM to calculate fuel consumption and costs for a car.

When the program has been entered, type Run 30, and the computer asks for the number of entries to be made. For each entry number you are asked to enter date, mileage, price per gallon and total cost of the petrol refill. When all entries have been made, an input of either 1 or 2 displays a list of seven dates or seven mileages which may be scrolled forwards or backwards.

By entering 400 and two entry numbers the computer will calculate and display the average fuel consumption in mpg and the total cost of petrol used between these two entry numbers. Alternatively, entering 500 saves the program so that it will run automatically when it is reloaded.

Lines 40-70 search the array I for the first unused element.

Lines 90-300 allow entry of all data.

Lines 320-510 contain the routines to produce the list of dates or mileages and its manipulation.

Lines 560-740 compute and display the mpg and petrol cost.

In lines 320, 330, 440 and 450 " " correspond to shift "Q".

If the program needs to be restarted, use Goto 40. The program will store up to 100 entries, but this may be changed by altering line 30.

Fuel economy.

```
5   REM "RUNNING - COSTS - 1981
10  REM DATA INPUT - RUN 30
20  GOTO 40
30  DIM I (100,4)
40  LET R=0
50  LET R=R+1
70  IF NOT I(R,1)=0 THEN GOTO  50
80  PRINT "CURRENT ENTRY NO.=";R
90  PRINT "HOW MANY ENTRIES DO YOU WISH TO MAKE?"
100 INPUT EN
110 FOR Q=R TO R+EN-1
120 PRINT "ENTRY:";Q
130 PRINT "ENTER DATE:";
140 INPUT D
150 PRINT D
160 PRINT "ENTER MILEAGE:";
170 INPUT M
180 PRINT M
190 PRINT "ENTER PRICE/GAL:";
200 INPUT PPG
210 PRINT "(POUND SIGN)";PPG
220 PRINT "ENTER TOTAL COST:"
230 INPUT TCOST
240 LET I(Q,1)=D
250 LET I(Q,2)=M
260 LET I(Q,3)=PPG
270 LET I(Q,4)=TCOST
290 CLS
300 NEXT Q
310 REM LIST MENU
320 PRINT "FOR LIST OF DATE PRESS ""1"""
330 PRINT "FOR LIST OF MILEAGES PRESS ""2"""
335 PAUSE 4000
340 POKE 16437,255
345 LETD$=INKEY$
350 IF D$="1" THEN LET M$"=""
355 IF D$="1" THEN LET DM=1
360 IF D$="2" THEN LET M$="ML."
365 IF D$="2" THEN LET DM=2
370 IF D$<"1" OR D$>"2" THEN GOTO 335
380 CLS
390 LET Q=1
400 FOR S=Q TO Q+6
410 PRINT S;":";I(S,DM);M$
420 NEXT S
430 PRINT "ENTER NO. TO SCROLL"
440 PRINT "ENTER ""400"" FOR MPG/COST"
450 PRINT "ENTER""500""TO SAVE"
460 INPUT SCROLL
470 IF SCROLL = 400 THEN GOTO 550
480 IF SCROLL = 500 THEN GOTO 780
490 LET Q=Q+SCROLL
500 CLS
510 GOTO 400
550 REM CALCULATE MPG AND COST
560 PRINT "ENTER START AND FINISH NO.S"
570 INPUT FE
580 INPUT LE
590 CLS
600 LET MILDIF=I(LE,2)-I(FE,2)
610 LET PQ=0
620 FOR X=FE+1 TO LE
630 LET PQ=PQ+(I(X,4)/(X,3))
640 NEXT X
650 LET MPG=MILDIF/PQ
660 LET PC=0
670 FOR X=FE+1TO LE
680 LET PC=PC+I(X,4)
690 NEXT X
700 PRINT "FROM ";I(FE,1);"-";I(FE,2);"ML. TO "
710 PRINT I(LE,1);"-";I(LE,2);"ML."
720 PRINT "A DISTANCE OF ";MILDIF;"ML."
730 PRINT "M.P.G.=";MPG
740 PRINT "COST OF PETROL=(POUND SIGN)";PC
750 PRINT "DO YOU WISH TO SAVE?"
760 INPUT C$
770 IF NOT C$="YES" THEN GOTO 310
780 CLS
790 PRINT "PRESS N/L WHEN READY"
800 INPUT Z$
810 IF Z$=""THEN SAVE "RUNNING-COSTS-1981"
820 CLS
830 GOTO 40
```

Star signs

IT IS NOT only the lovelorn and superstitious who are into astrology these days, writes Gordon Millington of Guildford, Surrey. Scientists too have found some very interesting correlations between the movements of heavenly bodies and more mundane events.

The theory is that the position of the planets at the time a child is born influences its fortune for the rest of its life. Among the most important features of the natal chart – a symbolic representation of planetary positions at the hour of birth — are the angles made by each of the nine planets with every other.

The program is written in TRS-80 Level II Basic and makes no use of machine code or hardware-specific routines. The astrologer really needs hard copy to pore over, so there is no attempt to present the results on the VDU although this can be done easily enough by omitting the L of LPrint and inserting Get or Inkey to stop scrolling as required. The printer is on-line throughout, and the only other commands specific to it are the codes in line 5. Those given are for the Tandy Line Printer VII and may be varied for other machines or omitted if output is to VDU.

After printing the heading in double-size characters, the program presents each of the planets in turn. It asks first for the position of the planet in degrees and then presents a menu in which the 12 astrological signs of the zodiac are presented and numbered in the conventional order, asking next for the number corresponding to the sign in which the planet is located to be input. This is repeated in lines 10 to 60 for each of the nine planets.

The computed aspects are presented as a half-matrix with the redundant repetitions being computed but suppressed in the printing. The first line of the printout gives the eight angles the Sun makes with the Moon, Uranus, Neptune, Mercury, Mars, Jupiter, Venus and Saturn. The second line gives the Moon's aspects, beginning with Uranus and is one datum shorter than the first since the Sun-Moon aspect is given in the previous line. Each successive line is thus shortened until all 36 aspects have been printed; the program ends with the Venus-Saturn aspect.

The aspect of 120 degrees, the trine, and its subdivisions 60 and 30 are generally held to be fortunate in diminishing degrees, whereas the 180 degrees angle or opposition is thought to be correspondingly unfortunate; 90 and 45 degrees are also unfortunate but less so. There is some controversy over how far on each side of the precise aspect its influence extends, and it varies with cases anyway. The conjunction, 0 degrees, is of varying significance.

Astronomical data are required to set up an original map from which the birth data are derived, but the matrix illustrated can provide a check on the accuracy of your keyed-in program. It is derived from the following data, which you can input when you run the program for the first time:

1 Sun 28 Leo
2 Moon 20 Leo
3 Uranus 12 Pisces
4 Neptune 16 Leo
5 Mercury 13 Virgo
6 Mars 19 Sagittarius
7 Jupiter 16 Libra
8 Venus 13 Libra
9 Saturn 5 Libra

Star signs program.

```
2 CLS
5 LPRINT CHR$(31);"ASTROLOGICAL ASPECTS":PRINT:LPRINT CHR$(30)
7 REM BY GORDON MILLINGTON, GUILDFORD, GU2 6QP.
9 DIM A(9):DIM D(80)
10 FOR J=1 TO 9
20 READ P$:PRINT P$
23 DATA SUN,MOON,URANUS
24 DATA "NEPTUNE","MERCURY","MARS"
25 DATA "JUPITER","VENUS","SATURN"
30 INPUT"HOW MANY DEGREES OF ITS SIGN";A(J)
40 GOSUB 600: CLS
50 ON S GOSUB 500,505,510,515,520,525,530,535,540,545,550,555
60 NEXT J
70 CLS
75 N=0
80 FOR X=1 TO 9:FOR Y=1 TO 9
90 K=A(X):Z=A(Y):D(N)=ABS(K-Z)
95 N=N+1
110 NEXT Y:NEXT X
120 FOR N=1TO8:LPRINT D(N);:NEXT:LPRINT"    SUN ASPECTS"
125 LPRINT
130 FOR N=11TO17:LPRINTD(N);:NEXT:LPRINT"    MOON ASPECTS"
135 LPRINT
140 FOR N=21TO26:LPRINTD(N);:NEXT:LPRINT"   URANUS ASPECTS"
145 LPRINT
150 FOR N=31TO35:LPRINTD(N);:NEXT:LPRINT"    NEPTUNE ASPECTS"
155 LPRINT
160 FOR N=41TO44:LPRINTD(N);:NEXT:LPRINT"    MERCURY ASPECTS"
165 LPRINT
170 FOR N=51TO53:LPRINTD(N);:NEXT:LPRINT"    MARS ASPECTS"
175 LPRINT
180 FOR N=61TO62:LPRINTD(N);:NEXT:LPRINT"    JUPITER ASPECTS"
185 LPRINT
190 LPRINT D(71):LPRINT"VENUS TO SATURN ASPECT"
200 LPRINT:LPRINT"Aspects in same order as Planets":END
500 RETURN
505 A(J)=A(J)+30:RETURN
510 A(J)=A(J)+60:RETURN
515 A(J)=A(J)+90:RETURN
520 A(J)=A(J)+120:RETURN
525 A(J)=A(J)+150:RETURN
530 A(J)=A(J)+180:RETURN
535 A(J)=A(J)+210:RETURN
540 A(J)=A(J)+240:RETURN
545 A(J)=A(J)+270:RETURN
550 A(J)=A(J)+300:RETURN
555 A(J)=A(J)+330:RETURN
600 PRINT"1.ARIES              2.TAURUS
605 PRINT"3.GEMINI             4.CANCER
610 PRINT"5.LEO                6.VIRGO"
615 PRINT"7.LIBRA              8.SCORPIO
620 PRINT"9.SAGITTARIUS       10.CAPRICORN
625 PRINT"11.AQUARIUS         12.PISCES"
630 PRINT:PRINT
635 INPUT"IN WHAT NUMBER OF SIGN IS THE PLANET LOCATED";S
640 RETURN
```

Star signs printout.

```
ASTROLOGICAL ASPECTS

 8  194  12  15  111  48  45  37      SUN ASPECTS

 202  4  23  119  56  53  45     MOON ASPECTS

 206  179  83  146  149  157    URANUS ASPECTS

 27  123  60  57  49      NEPTUNE ASPECTS

 96  33  30  22     MERCURY ASPECTS

 63  66  74     MARS ASPECTS

 3  11     JUPITER ASPECTS

 8
VENUS TO SATURN ASPECT

Aspects in same order as Planets
```

Life and bounce

FOR THE LAST few months Tandy Forum has had too many hex to decimal conversion programs, complains Andrew

(continued on page 150)

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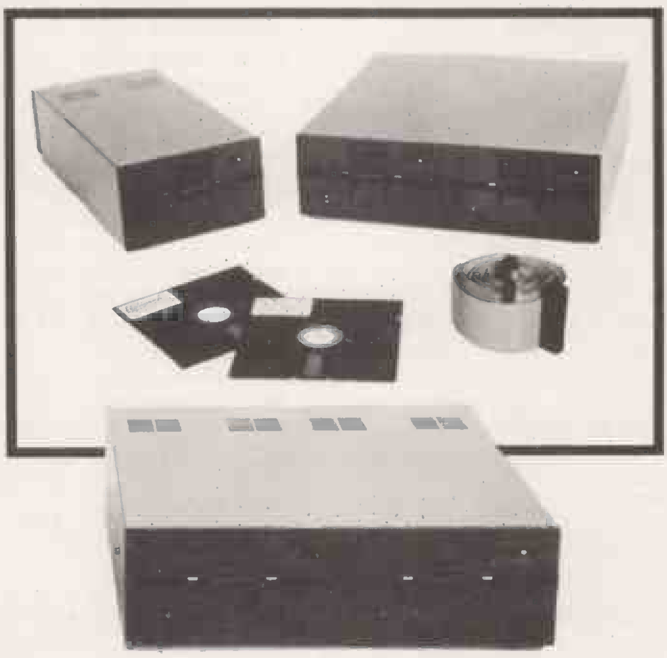

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Cylindrical life.

```
1 DEFINTA-Z:GOTO20
2 FORX=KTOK1:IFPEEK(X)=42THEN4
3 NEXT:IFPEEK(14400)=0THEN2ELSE30
4 IFPEEK(X-65)=42THEND=D+1ELSEC=-65
5 IFPEEK(X+1)=42THEND=D+1ELSEC=1
6 IFPEEK(X-64)=42THEND=D+1ELSEC=-64
7 IFPEEK(X+63)=42THEND=D+1ELSEC=63
8 IFPEEK(X+65)=42THEND=D+1ELSEC=65
9 IFPEEK(X+64)=42THEND=D+1ELSEC=64
10 IFPEEK(X-63)=42THEND=D+1ELSEC=-63
11 IFPEEK(X-1)=42THEND=D+1ELSEC=-1
12 IFD>MORD<STHENPOKEX,32ELSEIFD>PTHENPOKEX+C,42
13 D=0:C=0:GOTO3
20 CLS:PRINT:PRINT" ENTER  ( 0-8 ) ":PRINT:PRINT
21 INPUT" LEAST NUMBER OF SUROUNDING CELLS NEEDED
   FOR CELL TO SURVIVE";S
22 INPUT " MAXIMUM BEFORE DEATH ";M
23 INPUT "NUMBER AT WHICH REPRODUCTION
   CAN START";P
24 K=15425:K1=16319:CLS:SP=K:POKE SP,143
30 A£=INKEY£:IFA£=""THEN30
40 POKESP,32
50 IFA£="["THENGOTO2
60 IFA£="W"THENSP=SP-64:GOTO100
70 IFA£="X"THENSP=SP+64:GOTO100
80 IFA£="A"THENSP=SP-1:GOTO100
90 IFA£="D"THENSP=SP+1:GOTO100
95 IFA£="S"THENPOKESP,42:SP=SP+1
100 IFSP<15360THENSP=SP+1024
110 IFSP>16383THENSP=SP-1024
120 POKE SP,143:GOTO30
```

(continued from page 148)
Tunnicliffe of Tilton-on-the-Hill, Leicester, who has provided two programs to add a little life and bounce. Cylindrical Life is very simple: the keys W, X, A and D will move the cursor, while S fires a shot on to the screen.

When you have finished putting your cells on to the screen, press the Esc key, ↑ , to start the program. The screen is continually scanned to make it appear that one cell depends on the next at the time of scanning only, i.e., if one cell dies the death is recorded immediately. For each cell there are eight possible neighbours, given by lines 4 to 11. D is the total number of neighbours and C is the position — if any — of a space so that if reproduction occurs time is not wasted looking for an empty space again.

Speed is of the utmost importance, and you don't have to sit waiting for the next "scan" to see what is happening. The CPU is sent in a buzz between lines 3 and 13 until Esc is pressed. It is noticeable that the = operation is faster than using logical And. The top and bottom row are not used. This speeds up the program and prevents the Poking of system-crashing memory locations.

Breakout is more complicated. The moving character is controlled by the Peek (14400). After a breakout, more bricks are placed in both walls, and each brick is worth more. A bonus and extra ball are provided after every sheet beyond 1,000 points.

Screen print.

```
10  A$=".."
20  K=VARPTR(A$) :POKE K, 64
 :POKE K+1,0 :POKE K+2,60
30  FOR J = 1 TO 16: LPRINT A$
40  IF PEEK(K+1)<192 THEN POKE
K+1,PEEK(K+1)+64 : ELSE POKE
K+1,0 : POKE K+2,PEEK(K+2)+1
50  NEXT
```

Screen print

A SHORT BASIC ROUTINE for printing the contents of the screen comes from Gordon Grant of Crumpsall, Manchester. Only printable characters are acceptable, but otherwise it is very fast and convenient to use. It is best used by a Gosub following an Inkey$, otherwise the prompt will be printed as well.

A string-variable name entry is created at line 10. The length of this string is then forced to be 64, and its start address is forced to the start of screen RAM at line 20. The string is LPrinted 16 times, its start address being incremented by 64 each time.

Fireworks

FIREWORKS is a one-line program for Tandy and Video Genie users from Chris Harrison of New Ash Green, Kent:

```
10 CLS: FOR J = 1 to 5: N = RND(70) + 5: G = N + 121: FOR A = 16383 TO 15360 STEP – N: POKE A,G: NEXT A: FOR B = 16383 TO 15423 STEP – N: POKE N,G: NEXT B: NEXT J: GOTO 10
```

Users of other machines will need to know that 15360 is the top-left corner of the screen; 15423, top-right corner; 16319, bottom-left corner; 16383, bottom-right corner.

Breakout.

```
1 REM  ***  ))BREAKOUT((  BY A.J.TUNNICLIFFE  ***
2 CLEAR200:DEFINTA-Z:SC=0:SL=1:NM=4:GOTO300
3 CLS:BK£=CHR£(191):SS£=STRING£(63,149)
7 PRINT@10,STRING£(NM,136),"SCORE ";SC;:PRINT@33,"HIGH SCORE";HS;
8 PRINT@64,SS£;
9 FORR1=2TO14:FORRH=0TOBL:PRINT@R1*64+RH+D+30,BK£;:D=1-D:PRINT@R1*64+RH+52,BK£;:NEXT:NEXT:PRINT@960,SS£;
10 A=0:X=24:Y= 8:H=-1:V=0:K=15360:B=512+K:BA=140:BT=170:SP£=" ":POKEB,BT:BH=833+K:BS=191+K:FORWW=0TO2000:NEXT:GOTO60
20 G=PEEK(14400):IFG=0THEN45
21 IFG=16THENIFB<BHTHENPOKEB,32:B=B+64:POKEB,BT:GOTO45
22 IFG=8THENIFB>BSTHENPOKEB,32:B=B-64:POKEB,BT
45 IFX=1THEN59ELSEIFX>60THEN250
47 SP=X+H+(Y+V)*64+K:A=PEEK(SP)
50 IF A=32THENPOKE X+Y*64+K,32:X=X+H:Y=Y+V:POKESP,140 :GOTO20
55 IFA=149THENPOKEX+Y*64+K,32:V=-V:Y=Y+V:GOTO20
56 IFA=191THENPOKESP,32:H=-H:SC=SC+SL*10:PRINT@22,SC;:IFSC<HSTHEN60ELSEHS=SC:PRINT@43,HS;:GOTO60
59 Z=PEEK(Y*64+K):POKEY*64+K+1,32:X=2:IFZ=170THENH=1ELSE200
60 V=RND(3)-2:POKEX+Y*64,32:GOTO20
200 POKEB,32:NM=NM-1:IFNM<1THEN230ELSEPRINT@10,"     ";:PRINT@10,STRING£(NM,136);:FORDD=0TO2000:NEXT:GOTO10
230 CLS:SC=0:NM=4:FL=0:SL=1:PRINT:INPUT" DO YOU WANT TO PLAY AGAIN ";Q£:IFQ£="Y"THEN300ELSE END
250 CLS:FORGG=0TO7:PRINT@524,CHR£(23);" BREAKOUT !! ":FORDD=0TO300:NEXT:PRINT@524,STRING£(20,32);:FORDD=0TO300:NEXT:NEXT
251 CLS:IF SL>6 THEN 320 ELSE SL=SL+1
255 CLS:PRINT:PRINT:BP=BL*50:SC=SC+BP:PRINT:PRINTCHR£(23):PRINT,STRING£(BL,175);" X 50 "
260 PRINT:PRINT"            BONUS POINTS AWARDED ":PRINT:PRINT,CHR£(191);"=";SL*10:FORTT=0TO2000:NEXT:GOTO320
300 CLS:PRINT:PRINT:PRINT"   BREAKOUT        ...BY A.J.TUNNICLIFFE  ":PRINT:PRINT"  UP= (ESC)   DOWN = (CTRLL)

      HIT    'NEW LINE' TO PLAY  "
305 PRINT:PRINT:PRINT:PRINT,CHR£(191);" = 1 0"
310 SK£="":SK£=INKEY£:IFSK£="" THEN 310
320 IF SC>1000 THEN IF FL=0 THEN NM=NM+1
330 BL=2*SL:GOTO3
```

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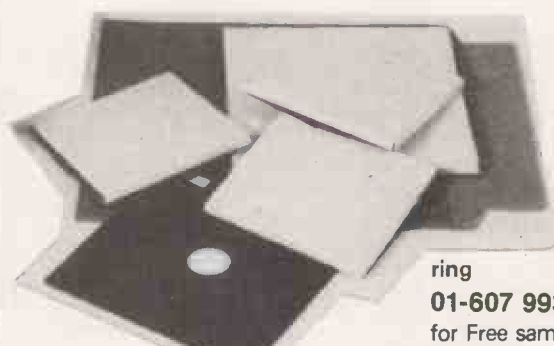

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Hard-copy graphics

HERE IS a routine from Keith Bremer of Manchester to produce graphics hard copy from a Nascom using the IOSL graphics board. The output is specifically designed for a Nascom Imp with the Imprint option, but could be modified easily for other printers with graphics capability.

The IOSL graphics board uses a memory-mapped display, where each bit represents a single pixel on the screen, and is 0 for black or 1 for white. Each byte in the display area holds eight bits on a horizontal line of the display.

```
                 ;************************************
                 ;* NASCOM GRAPHICS HARD-COPY OUTPUT *
                 ;* (IOSL screen graphics to NASCOM  *
                 ;*  IMP printer with IMPrint ROM)   *
                 ;************************************
                 ;
                 ;May be entered from BASIC or other
                 ;languages to give a hard copy of the
                 ;current graphics memory to the IMP.
                 ;No input parameters are required - the
                 ;necessary values being taken from the
                 ;graphics driver's workspace.
                 ;
                 ;. . . . . . . . . . . . . . . . . . . . .
                 ;
                 ;LABELS USED:
                 ;------------
30E0 0C91        DSPSZE EQU  £C91 ;the address of a byte
                 ;                ;containing the display
                 ;                ;size as no. of lines.
30E0 0C92        DSPSTT EQU  £C92 ;the address of a word
                 ;                ;holding the display start
                 ;                ;pointer to RAM
30E0 001F        GMODE  EQU  £1F ;IMPrint graphic mode
                 ;               ;initialisation
30E0 006F        SRLX   EQU  £6F ;NAS SYS serial output
                 ;
                 ;
                 ;STORAGE USED:
                 ;--------------
0FC0                    ORG  £FC0
0FC0 BD00        HINC   DEFW £00BD ;ie 0.74 as a binary mixed
                 ;                 ;number nn.ff in hex
0FC2 F000        HREM   DEFW 240   ;remaining bytes to fill
                 ;                 ;the IMP buffer to 760
                 ;
                 ;ROUTINE:
                 ;--------
0000                    ORG  0
0000 210000      HCOPY  LD   HL,0 ;initial Y coord
                 ;
                 ;The following loops down the screen,
                 ;outputting 7 screen lines at a time
                 ;
0003 3E1F        HC1    LD   A,GMODE ;IMP graphics mode
0005 DF6F               SCAL SRLX ;write A to printer
0007 010000             LD   BC,0 ;initial X coord
000A AF                 XOR  A ;previous byte output (initially 0)
000B 57                 LD   D,A ;fractional part of X coord = 0
                 ;
                 ;The following loops along a 7 line band
                 ;of the screen, outputting bytes to the
                 ;printer in graphic form
                 ;
000C E5          HC2    PUSH HL ;save Y
000D D5                 PUSH DE ;save X fraction
000E F5                 PUSH AF ;save prev byte
000F C5                 PUSH BC ;save X coord
0010 3E07               LD   A,7 ;mask for bit within byte
0012 A1                 AND  C ;get bit no (0..7)
0013 CB38               SRL  B ;divide X by 8 to get byte in line
0015 CB19               RR   C
0017 CB39               SRL  C
0019 CB39               SRL  C
001B 47                 LD   B,A ;bit no into B
001C 04                 INC  B ;adjust bit no.
001D AF                 XOR  A
001E 37                 SCF
001F 17          HC2A   RLA  ;shift A left to set bit mask
0020 10FD               DJNZ HC2A
0022 110700             LD   DE,£0007 ;D=current byte/E=line count
                 ;
```

(listing continued on next page)

For a complete line of video output, 48 bytes are strung together in a row to give 384 pixels in the x direction. Successive lines of 48 bytes each are used to provide up to 224 lines on the screen, 10·5K. See figure 1.

With the Imprint facility on the Nascom Imp, graphics output is possible, giving a horizontal resolution of 760 points with a slightly lower density vertical resolution. Output is achieved by sending a control character, 1F hex, followed by exactly 760 bytes to be printed in graphics mode. These bytes hold seven bits of data corresponding to the seven pins in the print head, leaving one bit which is ignored. The bit-to-pin relationship is shown in Figure 2.

At the end of printing a graphics line the Imp performs only a partial line-feed so that there is no gap between successive bands of graphics output. An image is formed by adding further bands of graphic output as far as necessary, as shown in figure 3.

This routine involves conversion from the horizontally-oriented bytes of the memory-mapped display to the vertically orientated bytes required by the printer.

Unfortunately the Imp does not give the same number of dots per inch vertically as it does horizontally. The ratio is about 74:100 or 0.74, so if pixels are transferred directly from the display, where the ratio should be about 1:1, then the printed image appears to be too tall. One method of avoiding this distortion is to adjust the output so that the printed image has the same proportions as the displayed picture. This routine does this by stepping along in the 'x' direction by 0.74 at a time instead of 1.0. This gives a much closer degree of geometric accuracy than direct output of pixels but means that some pixels are sampled twice during the output process.

The second problem is that the Imp print head cannot be driven so that one

Figure 1.

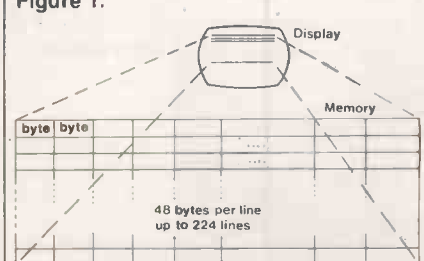
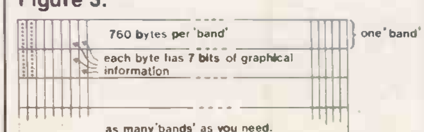


Figure 2.

Figure 3.



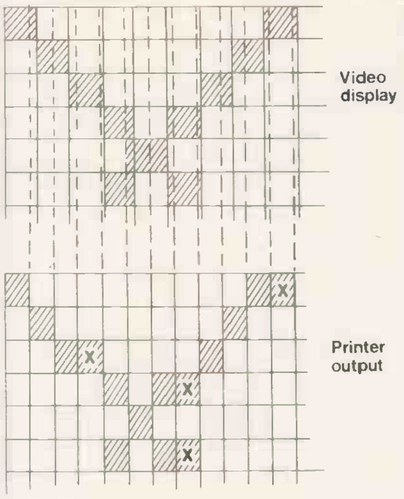


Figure 4.

pin will print two adjacent pixels. This problem only arises in graphics output, and is in any case taken care of by the Imprint routines inside the printer. However, if the program tries to print adjacent pixels, then Imprint lights the error lamp. To avoid this, the hard copy routine adjusts the output appropriately before sending the data to the Imp, by suppressing a bit, if the previous byte also had that bit set.

Considering these problems, it is possible to show how the routine builds up its output on the printer. This is shown in figure 4, which represents part of the screen display and the corresponding printer image. The screen display is overlaid with the corresponding printer display pixel positions in dotted lines. The pixels shaded but marked X would be set, but are suppressed by the routine.

The subroutine comprises three major loops, nested within each other, to output a single vertical byte, within a loop to output the 760 bytes needed for a single band, within a loop to output the total number of bands needed for the image. Two data words are used, to define the horizontal increment of 0.74 which may thus be changed by the user for other configurations and a count to define the number of bytes to fill out to 760 on a line. This is calculated as

HREM := 760 − INT(384/HINC)

where in this case HINC = 0.74 giving HREM approximately 240.

The filling-in bytes are all zeros, and since the Imp in normal mode ignores nulls, then the value of HREM need not be exact so long as the total number of bytes output is 760 or just over.

The code SCAL is a specific NasSys monitor code which generates a call to a subroutine, in this case the serial output routine, SRLX. This code may be replaced for other machines by an appropriate Call. The routine is relocatable, the assembly listing being given for an origin of 0000. It is also possible to hold the routine in the same RAM block as the graphics memory map.

(listing continued from previous page)

```
                   ;The following loops down 7 lines at the
                   ;current X coordinate to obtain a 7 bit
                   ;value to print
                   ;
0025 F5            HC3    PUSH AF ;save bit mask
0026 C5                   PUSH BC ;save position
0027 E5                   PUSH HL ;save Y
002B ED4B910C             LD   BC,(DSPSZE) ;no. of lines in display
002C 37                   SCF
002D ED42                 SBC  HL,BC ;compare with current Y
002F E1                   POP  HL
0030 C1                   POP  BC
0031 3017                 JR   NC,HC4 ;jump if Y = max Y
0033 E5                   PUSH HL ;save Y
0034 C5                   PUSH BC ;multiply HL by 48
0035 E5                   PUSH HL ;-----------------
0036 29                   ADD  HL,HL ;*2
0037 C1                   POP  BC
0038 09                   ADD  HL,BC ;*3
0039 29                   ADD  HL,HL ;*6
003A 29                   ADD  HL,HL ;*12
003B 29                   ADD  HL,HL ;*24
003C 29                   ADD  HL,HL ;*48
003D ED4B920C             LD   BC,(DSPSTT) ;start of display
0041 09                   ADD  HL,BC ;HL = addr of start of line
0042 C1                   POP  BC ;X displacement within line
0043 09                   ADD  HL,BC ;HL = addr of byte in line
0044 A6                   AND  (HL) ;test bit in byte
0045 E1                   POP  HL ;restore Y
0046 23                   INC  HL ;step Y down to next line
0047 2801                 JR   Z,HC4 ;skip carry if zero
0049 37                   SCF  ;set carry to shift into D
004A CB12          HC4    RL   D ;shift D for next bit
004C 1D                   DEC  E ;line count
004D 2805                 JR   Z,HC5 ;end loop if zero
004F F1                   POP  AF ;restore bit mask
0050 18D3                 JR   HC3 ;loop back
                   ;
                   ;end of loop to find 7 bit pattern
                   ;
0052 18AF          HCHALF JR   HC1 ;half way jump for outer
                   ;              ;loop for relocatability
                   ;
0054 F1            HC5    POP  AF ;lose bit mask
0055 C1                   POP  BC ;restore X coord
0056 F1                   POP  AF ;prev byte
0057 2F                   CPL  ;invert prev byte
0058 A2                   AND  D ;adjust current byte for IMP
                   ;(see note on IMPrint graphics pin
                   ;driving limitations!)
0059 D1                   POP  DE ;restore fraction of X
005A F5                   PUSH AF ;save current as prev
005B C5                   PUSH BC ;save X
005C DF6F                 SCAL SRLX ;write byte to printer
005E C1                   POP  BC
005F 78                   LD   A,B ;shift X 8 bits into A,B,C
0060 41                   LD   B,C
0061 4A                   LD   C,D ;fraction
0062 2AC00F               LD   HL,(HINC) ;X increment as nn.ff
0065 09                   ADD  HL,BC ;add lower 2 bytes
0066 CE00                 ADC  A,0 ;carry into top byte
0068 55                   LD   D,L ;store fraction in D
0069 4C                   LD   C,H ;whole part in BC
006A 47                   LD   B,A
006B 218001               LD   HL,384 ;max X value
006E 37                   SCF
006F ED42                 SBC  HL,BC ;compare X with max X
0071 E1                   POP  HL ;restore prev byte into H
0072 7C                   LD   A,H ;then A
0073 E1                   POP  HL ;restore Y
0074 3096                 JR   NC,HC2 ;loop back for next X
                   ;
                   ;end of loop to output a band 7 lines wide
                   ;
0076 ED4BC20F             LD   BC,(HREM) ;bytes to fill IMP buffer
007A 04                   INC  B ;adjust in case zero
007B 0C                   INC  C
007C AF                   XOR  A ;set output to zero
007D DF6F          HC6    SCAL SRLX ;write A to printer
007F 0D                   DEC  C
0080 20FB                 JR   NZ,HC6
0082 10F9                 DJNZ HC6 ;write nulls until BC = 0
0084 010700               LD   BC,7 ;increment for Y
0087 09                   ADD  HL,BC ;step to next band
0088 ED4B910C             LD   BC,(DSPSZE) ;display size
008C E5                   PUSH HL
008D 37                   SCF
008E ED42                 SBC  HL,BC ;compare Y with max Y
0090 E1                   POP  HL
0091 38BF                 JR   C,HCHALF ;loop if not yet >= max Y
0093 C9                   RET
                   ;
                   ;end of routine
                   ;
```

QERA changes

THE QERA ROUTINE by David Meeks, Disc Dialogue, January 1982, is most useful, writes A P Hill of Exeter, Devon, but there appears to be one major error and two minor errors in the listing. The algorithm to calculate the position of the unambiguous file name, UFN, in the directory buffer is false. It always returns the wrong location when the UFN is located at the start of the buffer, 0080H returning the value 0000H.

As only the lowest two bits of the value returned by the BDOS in register A are of interest to us, a better algorithm is to simply check the value of these bits, giving four possible values — 0, 1, 2 and 3. These values show exactly where the UFN is located in the buffer.

Listing 1.

```
BUFPOS MVI B, 1  ; counter =1
       RRC       ; lowest bit set?
       JNC NOLSB ; jump if not set
       INR B     ; inc count if set
NOLSB RRC        ; next lowest bit set?
       JNC NONSB ; jump is not set
       INR B     ; inc count by 2 as
       INR B     ; this bit = 2
NONSB LXI H, 60H ; 20H below buffer start
       LXI D, 20H
FCBLP DAD D      ; add 20H to value in
       DCR B     ; H until count = 0
       DNZ FCBLP
```

```
0 = first UFN    0080H
1 = second UFN   00A0H
2 = third UFN    00C0H
3 = fourth UFN   00E0H
```

The code in listing 1 will achieve the required result. The H register now contains start location of UFN in buffer, and this piece of code should be substituted for the lines after

NEXT: dcr A

up to, and including the line

mov L, A

The return from this routine to CP/M is liable to produce errors. A better method is to store the value of the stack-pointer on entry to the routine — say, in OLDSP — and restore this value on exit from the routine. Further, the return to CP/M should be via a jump to the main entry point at 0000H, and not via a return. Thus

```
START LXI, H, 0H
   DAD SP
   SHLD OLDSP
   LXI H, STACK + 32
   SPHL
```

and

```
BOOT LHLD OLDSP
   SPHL
   JMP 0000H
```

The section of code to print the drive number, within Print: is incorrect. As the drive number will be 0, 1, 2, etc., adding the value 40H will produce the ASCII codes A, B, etc. Thus 41H and not 40H should be added in the seventh line of this section.

File sizes

THIS CP/M PROGRAM from Jonathan Palfrey of Warwick, written for the Microsoft assembler, counts the number of lines in a file. It operates by counting characters and end-of-file markers which are not preceded by CR or LF.

The program returns to the CCP when finished. This improves its speed, but means that it cannot be included in Sub files. If you find this feature inconvenient, change the last two occurrences of "ret" to "jp 0".

Listing 2.

```
L100,102
 0100  JMP  1600
 0103
L1600,1631
 1600  LDA  0080
 1603  CPI  00
 1605  JZ   1615
 1608  CPI  03
 160A  JNZ  0433
 160D  LDA  0083
 1610  CPI  3A
 1612  JNZ  0433
 1615  LXI  H,005D
 1618  MVI  A,3F
 161A  MOV  M,A
 161B  INR  L
 161C  MOV  M,A
 161D  INR  L
 161E  MOV  M,A
 161F  INR  L
 1620  MOV  M,A
 1621  INR  L
 1622  MOV  M,A
 1623  INR  L
 1624  MOV  M,A
 1625  INR  L
 1626  MOV  M,A
 1627  INR  L
 1628  MOV  M,A
 1629  INR  L
 162A  MOV  M,A
 162B  INR  L
 162C  MOV  M,A
 162D  INR  L
 162E  MOV  M,A
 162F  JMP  0433
```

Continually typing STAT *.* can become tedious and a small patch will enable you to type STAT, STAT B:, or indeed STAT D: — if you have four disc drives — and get the full listing of all file names and sizes. Any superfluous blanks in the command line will result in the original one-line message being displayed.

The first instruction in STAT.COM is an unconditional jump to 0433H. My patch substitutes a jump past the end of the program, and then jumps to 0433H. This can be done using DDT, and the result appears as in listing 2.

Notice that you can still get the one-line display of remaining space, if you really want it, by typing "STAT " — with a space before the closing quotation marks. Also, the original "STAT *.*" command still works, as do all the other STAT options.

The new version of STAT.COM may be saved on disc by giving the command

SAVE 22 STAT.COM

immediately after getting out of DDT.

The resulting version of STAT is of course non-standard, but I think the change is a significant convenience if you want the full listing and only a very minor inconvenience if you want the one-line display.

File sizes.

```
        aseg
        org     100h

        ld      de,92           ; default fcb
        ld      c,15
        call    5               ; open file
        cp      255
        jp      z,nofile

        ld      b,10            ; "last character" = LF
        ld      hl,0            ; set line count to 0

rrec:   push    bc              ; push last character
        push    hl              ; push line count
        ld      de,92           ; default fcb
        ld      c,20
        call    5               ; read from file
        pop     hl              ; pop line count
        pop     bc              ; pop last character
        cp      0               ; successful read?
        jp      nz,nexit

        ld      de,128          ; start of default buffer
nextc:  ld      a,(de)          ; get next char from buffer
        cp      26              ; if end of file
        jp      z,iseof         ; jump out of rrec loop

        cp      13              ; if CR then
        jp      nz,notcr
        inc     hl              ; increment line count
notcr:  ld      b,a             ; remember last character
        inc     de              ; increment pointer to buffer
        ld      a,d
        cp      0               ; if still within buffer
        jp      z,nextc         ; go to next character
        jp      rrec            ; else read new record

iseof:  ld      a,b             ; look at last character
        cp      10
        jp      z,nexit
        cp      13
        jp      z,nexit
        inc     hl              ; increment line count if not LF or CR

nexit:  ld      bc,lc$          ; HL holds line count to be put into lc$
        ld      iy,p10tab       ; power-of-ten table
loop0:  ld      a,'0'           ; set digit count = 0
        ld      e,(iy)
        ld      d,(iy + 1)      ; load de with power of ten
loop1:  or      a               ; clear carry
        sbc     hl,de           ; subtract power of ten
        jp      c,jump1         ; go if done
        inc     a               ; increment digit count
        jp      loop1

jump1:  add     hl,de           ; restore to positive
        ld      (bc),a          ; store digit count
        inc     bc              ; increment buffer pointer
        inc     iy
        inc     iy              ; point to next power of ten
        ld      a,1
        cp      e               ; if power-of-ten ~= 1
        jp      nz,loop0        ; repeat outer loop

        ld      de,lc$          ; get address of line count string
nextlz: ld      a,(de)          ; go past leading zeroes
        cp      '0'
        jr      nz,lzfin
        inc     de
        jp      nextlz

lzfin:  ld      c,9             ; display line count string
        call    5
        ret                     ; and return to CCP

nofile: ld      de,nf$
        ld      c,9
        call    5
        ret                     ; return to CCP

p10tab: defw    10000,1000,100,10,1
lc$:    defb    '      lines : 30 jun 1981 : jpr palfrey$'
nf$:    defb    'no such file$'
```

Musical moments

PROGRAMS on Apple II Plus which are repetitive in nature can be livened up considerably by including short tunes, writes Michael Findlay of Belfast. These can easily be added to any Basic program and are particularly useful in acting as a reward for a correct response.

There are two methods of adding a tune to a program. The Apple II's speaker can be addressed by means of a machine-code routine which will have to be BLoaded at the start of the program. Alternatively the routine can be entered as Poke statements directly from the program, perhaps as a subroutine.

The ITT 2020 manual gives one particular machine-code routine for playing a tune, but this is unsuitable for the Apple II, as it would occupy a portion of its zero-page memory already in use. This machine code has therefore been amended slightly so that it occupies a vacant part of the Apple II memory near the top of page two, starting at address $02E2—738 decimal in listing 1.

It is a very short program and is easily entered from the keyboard in the usual manner:

```
CALL — 151
0E2  :  AD30  C0  88  D0  05
......etc.    Return
```

After entering, check the listing by

```
02E2 L
```

and the listing should appear on the screen. It may now be saved on disc by the command

```
BSAVE TUNE,A$ 02E2, L21
```

Alternatively, instead of using this method, the equivalent information may be Poked into the same memory locations using a Gosub like the routine shown in listing 2. The disadvantage of this method is that this subroutine has to be typed into each program which requires a tune, whereas two instructions inserted somewhere near the start of your program such as:

```
40 D$ = CHR$ (4) : REM Control D
50 PRINT D$; "BLOAD TUNE, A$ 02E2"
```

will add the same information to the memory from disc with less trouble.

The frequency and the length of a note are determined by the speed at which loops are executed in the machine-code routine. The routine searches for the pitch value — between zero and 255 — in location $02E0 — 736 decimal — and the length value in location $02E1 — 737 decimal. The appropriate values must be Poked into these locations from the Basic program.

The pitch values are given in table 2. For notes one octave higher, simply halve the values given. The length of the notes are shown in table 1.

To play a single note, you have only to insert the following instructions:

```
100 POKE 736, 195:   POKE 737, 128:
       Pitch              Length
CALL 738
Monitor routine
```

To play a tune with a sequence of notes, it is easier to add the pitch and length values of the various notes as Data statements and Read the pitch P and length L as illustrated in the sample program.

In line 260, the length of all the notes in a tune may be changed by altering the value of M in line 220, subject to L < 255. If M > 1 then the tune is slowed down, and if M < 1 the tune is speeded up. Various interesting effects may also be obtained by letting M vary and play just one note.

Listing 1.

```
$02E2L
 02E2-   AD 30 C0    LDA   $C030
 02E5-   88          DEY
 02E6-   D0 05       BNE   $02ED
 02E8-   CE E1 02    DEC   $02E1
 02EB-   F0 09       BEQ   $02F6
 02ED-   CA          DEX
 02EE-   D0 F5       BNE   $02E5
 02F0-   AE E0 02    LDX   $02E0
 02F3-   4C E2 02    JMP   $02E2
 02F6-   60          RTS
```

Table 1.

(2)	(1½)	(1)	(½)	(¼)
𝅗𝅥	𝅘𝅥.	𝅘𝅥	𝅘𝅥𝅮	𝅘𝅥𝅯
255	192	128	64	32

Listing 2.

```
20       GOSUB 30000
30000    REM....Basic Version of Tune
30010    DATA  173,48,192,136,208,5,206,225,2,240,9
30020    DATA  202,208,245,174,224,2,76,226,2,96
30030    FOR I = 738 TO 758
30040    READ R : POKE I,R
30050    NEXT: RETURN
```

Table 2.

G	G#	A	B♭	B	C	C#	D	E♭	E	F	F#
255	242	228	216	205	195	185	175	164	152	145	135

Sample program.

```
100  REM  *** BLUE DANURE ***
110  REM  PITCH & LENGTH OF NOTES

120  REM   WRITTEN AS CONSECUTIVE
             NUMBERS
130  REM   IN FOLLOWING DATA
              STATEMENTS
140  DATA  128,128,128,128,102,12
     8,87,128,87,255,87,128,87,25
     5,102,128,102,255
150  DATA  128,128,128,128,102,12
     8,87,128,87,255,87,128,87,25
     5,97,128,97,255
160  DATA  135,128,135,128,114,12
     8,76,128,76,255,76,128,76,25
     5,97,128,97,255
170  DATA   135,128,135,128,114,1
     28,76,128,76,255,76,128,76,2
     55,102,128,102,255
180 D$ =  CHR$ (4)
190  PRINT D$;"BLOAD TUNE,A$02E2"

200  REM  SPECIFY NO.(X) OF NOTES

210 X = 36
220 M = 1
230 F = 736:LN = 737:T = 738
240  FOR I = 1 TO X
250  READ P,L
260 L =  INT (L * M): IF L > 255 THEN
     L = 255
270  POKE F,P: POKE LN,L: CALL T
280  NEXT
```

Letter Shuffle

THE OBJECT of the Letter Shuffle game by SA Reedy of Portsmouth, Hampshire is to shuffle the lines and columns in the square until the result shown in figure 1 is obtained.

The rows and columns may be shifted simply by pressing the key labelled for that row or column. In the bottom right-

```
 ! 1 ! 2 ! 3 ! 4 ! 5 ! 6 ! 7 ! 8 ! 9 !
-+---+---+---+---+---+---+---+---+---+
A! A   B   C ! A   B   C ! A   B   C !
-+
B! D   E   F ! D   E   F ! D   E   F !
-+
C! G   H   I ! G   H   I ! G   H   I !
-+-----------+-----------+-----------+
D! A   B   C ! A   B   C ! A   B   C !
-+
E! D   E   F ! D   E   F ! D   E   F !
-+
F! G   H   I ! G   H   I ! G   H   I !
-+-----------+-----------+-----------+
G! A   B   C ! A   B   C ! A   B   C !
-+
H! D   E   F ! D   E   F ! D   E   F !
-+
I! G   H   I ! G   H   I ! G   H   I !
-+-----------+-----------+-----------+
```

Letter Shuffle — figure 1.

hand side of the screen there is a section which says whether your columns move from top to bottom, or bottom to top. Likewise it will tell you whether your rows move right to left, or left to right. This can be reversed simply by pressing the space bar.

Lines 60 to 200 print instructions, while lines 210 to 320 print square grid, column and row labels. Lines 330 to 450 randomly places data into two-dimensional array and lines 460 to 940 in the main program accept your move, shift appropriate columns and rows within the array and update the displayed grid and score.

The program displays a direct map of a nine-by-nine two-dimensional array. All movements within the array use a subroutine as shown in lines 570 to 640.

Screen dump

IF YOU BOUGHT an 80-column Epson printer for your trusty 40-column Apple II Shaun Hope of Milton Malsor, Northamptonshire has a program which will solve your printout problems. Unless you have an 80-column card your first printout will come out like a typographer's nightmare with random spacing and columns of higgledy-piggledy figures.

Inserting the appropriate printer format commands in all your programs and adding subroutines to switch the printer off and on at the right times would take hours. This simple subroutine is easy to incorporate into your existing programs and will enable the printer to reproduce the Apple 40-column format exactly as it appears on the screen. Admittedly you will be wasting half of each sheet of paper on the printout, but the extra space is very useful for adding comments. The general principles of this subroutine can be adapted for other machines provided that the screen display is memory mapped, that is, screen location is stored somewhere in accessible memory.

The Apple primary text screen consists of 40 columns and 24 rows, giving 960 possible positions for each screen character. Each character displayed on the screen is the content of one memory location. The actual memory used begins at decimal location 1024 and ends at 2047 and is thus 1,024 bytes long. The

(continued on next page)

Letter Shuffle.

```
1   REM ************************
2   REM *                      *
3   REM * LETTER SHUFFLE GAME *
4   REM * CONCIEVED & WRITTEN *
5   REM * BY S.A.REEDY 6/5/81 *
6   REM *                      *
7   REM ************************
10 D = 0
20 HT = 3:HI = 23:SC = 0: DIM D$(8),P$(8,8)
30  HOME
40  VTAB 1: HTAB HI
50  PRINT "LETTER SHUFFLE"
60  HTAB HI: PRINT
70  HTAB HI: PRINT "YOU MAY MOVE ANY"
80  HTAB HI: PRINT "ROW OR COLUMN BY"
90  HTAB HI: PRINT "PRESSING:-": PRINT
100  HTAB HI: PRINT "ROW.......(A-I)"
110  HTAB HI: PRINT "COLUMN....(1-9)"
120  PRINT
130  HTAB HI: PRINT "PRESSING THE   "
140  HTAB HI: PRINT "SPACE BAR WILL "
150  HTAB HI: PRINT "CHANGE DIECTION"
160  HTAB HI: PRINT "OF MOVEMENT": PRINT
170  HTAB HI: PRINT "PRESENT DIRECTION"
180  HTAB HI: PRINT "LEFT TO RIGHT"
190  HTAB HI: PRINT "TOP TO BOTTOM"
200  PRINT : HTAB HI: PRINT "MOVE # ";
210  VTAB 1
220  HTAB 1: PRINT "  1 2 3 4 5 6 7 8 9"
230  FOR X = 1 TO 9
240  VTAB (2 * X)
250  HTAB HT - 2: PRINT " "
260  VTAB (2 * X) + 1
270  HTAB HT - 2: PRINT  CHR$ (X + 192)
280  NEXT
290  FOR ZZ = 2 TO 20: HTAB HT - 1: VTAB ZZ
300  IF ZZ = 8 OR ZZ = 14 OR ZZ = 2 OR ZZ = 20 THEN  PRINT "+-----+-----+
     -----+": NEXT
310  IF ZZ =  > 20 THEN 330
320  PRINT "!     !     !     !": NEXT
330  DATA  "A","B","C","A","B","C","A","B","C"
340  DATA  "D","E","F","D","E","F","D","E","F"
350  DATA  "G","H","I","G","H","I","G","H","I"
360  FOR H = 0 TO 8: FOR V = 0 TO 8
370 P$(H,V) = ".": NEXT : NEXT
380  FOR R1 = 1 TO 3: FOR R2 = 1 TO 27
390 H =  INT ( RND (1) * 9):V =  INT ( RND (1) * 9)
400  IF P$(H,V) <  > "." THEN 390
410  READ P$(H,V)
420  HTAB (2 * H) + HT: VTAB (2 * V) + 3: PRINT P$(H,V)
430  NEXT
440  RESTORE
450  NEXT
460  FOR H = 0 TO 8: FOR V = 0 TO 8
470  HTAB (2 * H) + HT: VTAB (2 * V) + 3: PRINT P$(H,V)
480  NEXT : NEXT
490 H = 0:V = 0: HTAB HI + 7: VTAB 19: PRINT SC
500  VTAB 19: HTAB 40: GET K$
510  IF  ASC (K$) = 32 AND D = 1 THEN D = 0: GOSUB 890: GOTO 500
520  IF  ASC (K$) = 32 AND D = 0 THEN D = 1: GOSUB 920: GOTO 500
530  IF  ASC (K$) < 65 OR  ASC (K$) > 73 THEN 550
540 V =  ASC (K$) - 65: GOTO 710
550  IF  VAL (K$) > 0 AND  VAL (K$) < 10 THEN H = ( VAL (K$) - 1): GOTO 5
     70
560  GOTO 490
570  FOR V = 0 TO 8
580 A$(V) = P$(H,V)
590  NEXT
600  IF D = 1 THEN 630
610  FOR X = 0 TO 8:Y = X - 1: IF Y < 0 THEN Y = 8
620  GOTO 640
630  FOR X = 0 TO 8:Y = X + 1: IF Y > 8 THEN Y = 0
640 P$(H,X) = A$(Y): NEXT
650  FOR V = 0 TO 8
660  HTAB (2 * H) + HT
670  VTAB (2 * V) + 3
680  PRINT P$(H,V)
690  NEXT
700 SC = SC + 1: GOTO 490
710  FOR H = 0 TO 8
720 A$(H) = P$(H,V)
730  NEXT
740  IF D = 1 THEN 820
750  FOR X = 0 TO 8:Y = X - 1: IF Y < 0 THEN Y = 8
760 P$(X,V) = A$(Y): NEXT
770  FOR H = 0 TO 8
780  HTAB (2 * H) + HT: VTAB (2 * V) + 3
790  PRINT P$(H,V)
800  NEXT
810 SC = SC + 1: GOTO 490
820  FOR X = 0 TO 8:Y = X + 1: IF Y > 8 THEN Y = 0
830 P$(X,V) = A$(Y): NEXT
840  FOR H = 0 TO 8
850  HTAB (2 * H) + HT: VTAB (V * 2) + 3
860  PRINT P$(H,V)
870  NEXT
880 SC = SC + 1: GOTO 490
890  HTAB HI: VTAB 16: PRINT "LEFT TO RIGHT"
900  HTAB HI: VTAB 17: PRINT "TOP TO BOTTOM"
910  RETURN
920  HTAB HI: VTAB 16: PRINT "RIGHT TO LEFT"
930  HTAB HI: VTAB 17: PRINT "BOTTOM TO TOP"
940  RETURN
```

Screen dump.

```
9  REM   >>  TEXT SCREEN DUMP  <<
19  REM    A SIMPLE METHOD OF
       DUMPING AN APPLE ][ TEXT
         SCREEN ONTO AN EPSON
         PRINTER  ::  DEVISED
            BY   SHAUN HOPE
       >>>  COPYRIGHT 1981  <<<
29  REM  WRITTEN ON A 48K DOS 3.3
         SYSTEM WITH AN MX-82
       PRINTER/INTERFACE TYPE 2
```

Part 1.

```
99  REM  DOS & PRINTER CONTROL
       CODES TO BE INITIALISED
       IN MAIN PROGRAM
100 R$ =  CHR$ (13):D$ = R$ +  CHR$
    (4)
109  REM  PRINTER IN SLOT 1
110 SLOT = 1
169  REM   REFER TO P.15 OF THE
     APPLE ][ REFERENCE MANUAL
     FOR SCREEN CODES
179  REM  A$ CONTAINS THE ASCII
     SCREEN CODE 0 (THE @ SYMBOL)
189  REM  L$ CONTAINS THE ASCII
     SCREEN CODES EXCEPT 0 IN
     CORRECT ORDER
199  REM  L$ & A$ SHOULD ALSO BE
     DEFINED IN THE MAIN PROGRAM
200 A$ = "@"
210 L$ = "ABCDEFGHIJKLMNOPQRSTUVW
     XYZ" +  CHR$ (91) +  CHR$ (9
     2) + "]^" +  CHR$ (95) + " !
     " +  CHR$ (34) + "£$%&'()*+,
     -./0123456789:;<=>?"
220 L$ = L$ + A$ + L$ + A$ + L$ +
     A$ + L$
230  GOTO 2000: REM  A DEMO
```

Part 2.

```
989  REM  THIS IS THE MAIN
     ROUTINE FOR TEXT DUMP.
     INSERT IT IN YOUR MAIN
     PROGRAM AS A SBR, THEN
     PROVIDE AN OPTION TO USE
     IT IN YOUR SCREEN DISPLAY.
999  REM  SWITCH ON PRINTER AND
     OUTPUT TO PRINTER ONLY
1000  PRINT D$"PR£"SLOT;R$: POKE
     1656 + SLOT,72
1005  PRINT  CHR$ (27) CHR$ (65) CHR$
     (8);
1009  REM  I,J,K LOOPS CHECK WHAT
      IS ON THE TEXT SCREEN (REF.
      MANUAL P.16)
1010  FOR I = 1024 TO 1104 STEP 4
     0
1020  FOR J = I TO I + 896 STEP 1
     28
1030  FOR K = 0 TO 38
1039  REM  CHECK WHAT IS ON THE
      SCREEN
1040 X =  PEEK (J + K)
1049  REM   PRINT THE RELEVANT
      SYMBOL
1050  IF X = 0 THEN  PRINT A$;: GOTO
     1070
1060  PRINT  MID$ (L$,X,1);
1070  NEXT K
1079  REM   PRINT THE LAST COLUMN
      (OMIT SEMICOLON THIS TIME
      SO THAT WE ARE READY FOR
      NEXT LINE).
1080 X =  PEEK (J + 39)
1090  IF X = 0 THEN  PRINT A$: GOTO
     1110
1100  PRINT  MID$ (L$,X,1)
1110  NEXT J,I
1115  PRINT  CHR$ (27) CHR$ (65) CHR$
     (12)
1119  REM  RESTORE SCREEN OUTPUT
1120  POKE 11657 + SLOT,40
1129  REM  SWITCH PRINTER OFF
1130  PRINT D$"PR£0"
1140  RETURN : REM  ROUTINE ENDS
```

Part 3.

```
1989  REM  THIS IS AN EXAMPLE OF
      HOW TO USE THE DUMP ROUTINE
1999  REM   FIRST WRITE A TEXT
      SCREEN PAGE
2000  TEXT : HOME
2010  PRINT ">>> DEMONSTRATION OF
      TEXT DUMP TO AN <<<>>>" SPC(
     10)"EPSON  PRINTER" SPC( 10)
     "<<<>>>    BY S.HOPE   COPYR
     IGHT 1981    <<<"
2020  FOR N = 5 TO 23: VTAB N: HTAB
     N: PRINT "LINE "N: NEXT
2029  REM  PROTECT ALL BUT THE
      BOTTOM LINE FROM SCROLLING.
2030  POKE 34,23
2040  HOME : PRINT "KEY:  <P>RINT
     OUT   <E>ND   <?>  ";: GET I
     $
2050  IF I$ = "P" THEN  GOSUB 100
     0: GOTO 2040
2060  IF I$ = "E" THEN 2080
2070  GOTO 2040
2080  POKE 34,0: HOME : END
```

(continued from previous page)

64-byte difference between 960 bytes and 1024 bytes is not used by the screen display but for peripheral devices.

A map of the text screen on page 16 of the Apple II reference manual shows that the locations are not in normal arithmetical progression, though there is some logical order to them — this is why three loops are necessary.

The screen-dump program first looks at each of the screen locations in turn from top left to bottom right of the screen. Then it decides which screen character is stores at that location. Next it determines a suitable printer character to use, and finally it prints that out. The program takes the precaution of protecting the display while this is taking place.

Part one of the program consists of variables which need to be initialised in the main part of your program. Lines 100 and 110 initialise necessary DOS and printer controls and set the printer interface to slot one. Lines 200, 210 and 220 initialise two string variables A$ and L$. The 256 possible screen characters, including inverse and flashing characters are defined on page 15 of the Apple II reference manual. The first screen character is placed in A$; the remaining 255 are placed in L$. Two string variables are required because a string variable can hold no more than 255 characters.

The use of these string variables is necessary in the first place because there are considerable differences between the normal ASCII character codes and the Apple ASCII screen codes. For example, ASCII code 13 is a Control-M—Return— but Apple screen code 13 is an Inverse-M. String variables allow you to decide what to print in place of characters displayed on the screen in inverse or flashing mode. This program will print these characters as normal upper case.

In part two, line 1000 switches on the printer. Note the vital R$ which is ASCII 13, Return. The Poke kills any output to the screen to avoid disturbing the screen display while printing it out. Line 1005 is an optional extra, reducing the spacing between lines on the printer to give hard copy which is in better proportion to the screen display.

Lines 1010, 1020 and 1030 loop to follow a correct sequence round the text page, location by location. The exceptions are the locations in the last column. Line 1040 determines the screen code of the character at the location.

At line 1050, if the screen code is zero then a normal @ symbol is printed on the printer. In line 1060, if the screen code does not equal zero, then the appropriate character is selected from L$ and printed on the printer.

Lines 1070 to 1100 are similar to lines 1040 to 1060 but this time no semicolon is included in the Print statements in order to end a line. Line 1115 is optional; it should be included if line 1005 was included to restore line spacing to normal.

Lines 1120 and 1130 restore output to the screen and switch off the printer. R$ is not necessary this time — unlike line 1000 where the printer is switched on.

The third part demonstrates how the routine may be used from a program. Lines 2000 to 2020 creates a demonstration display. Line 2030 protects the screen display, except for the bottom line. In line 2040, the bottom line of the display is used for prompting. Keying P dumps the display on the printer but does nothing else to the display.

Cash Display.

```
10  REM  MAKE VARIABLE TO BE PRINTED = Z.
20  REM  THEN GOSUB 50000
30  REM   USE 'PRINT ZZ$' TO PRINT VARIABLE CORRECTLY FORMATTED & ROUNDED TO NEAREST PENNY.
40  REM  USE 'TAB( # - LEN(ZZ$))' TO TAB ZZ$ AND BRING DECIMAL POINTS INTO VERTICAL LINE.
50  REM  'CASH FORMAT SUBROUTINE' MODIFIED L.NELSON-JONES FEB 1982 TO ALLOW FOR -VE NUMBERS (CREDITS)
50000 ZZ = 0:.IF Z ( 0 THEN ZZ = 1
50010 Z =  ABS (Z):Z =  INT (Z * 100 + 0.5) / 100
50020 ZX$ = ".00": IF Z =  INT (Z) THEN ZY$ =  STR$ (Z)
50030  IF Z ( )  INT (Z) THEN  GOTO 50060
50040 ZZ$ = ZY$ + ZX$: IF ZZ = 1 THEN ZZ$ = "-" + ZZ$
50050  RETURN
50060 Z$ =  STR$ (Z -  INT (Z) + 0.00001):YY$ =  LEFT$ (Z$,3):Z$ =  STR$ ( VAL (YY$)):ZY$ =
     STR$ ( INT (Z)): IF  LEN (Z$) = 2 THEN
ZZ$ = ZY$ + YY$: GOTO 50100
50070  IF Z ( 1 AND Z ) 0 THEN YY$ = "0": GOTO 50090
50080 ZZ$ =  STR$ (Z): GOTO 50100
50090 ZY$ = STR$ (Z):ZZ$ = YY$ + ZY$
50100  IF ZZ = 1 THEN ZZ$ = "-" + ZZ$
50110  RETURN
```

Cash display

L NELSON-JONES from Bournemouth. found that Gerard Noel's subroutine for formatting cash figures, Apple Pie, September 1981, became rather tangled if negative numbers such as refunds or credits were introduced. This revision makes this very useful subroutine work in all cases.

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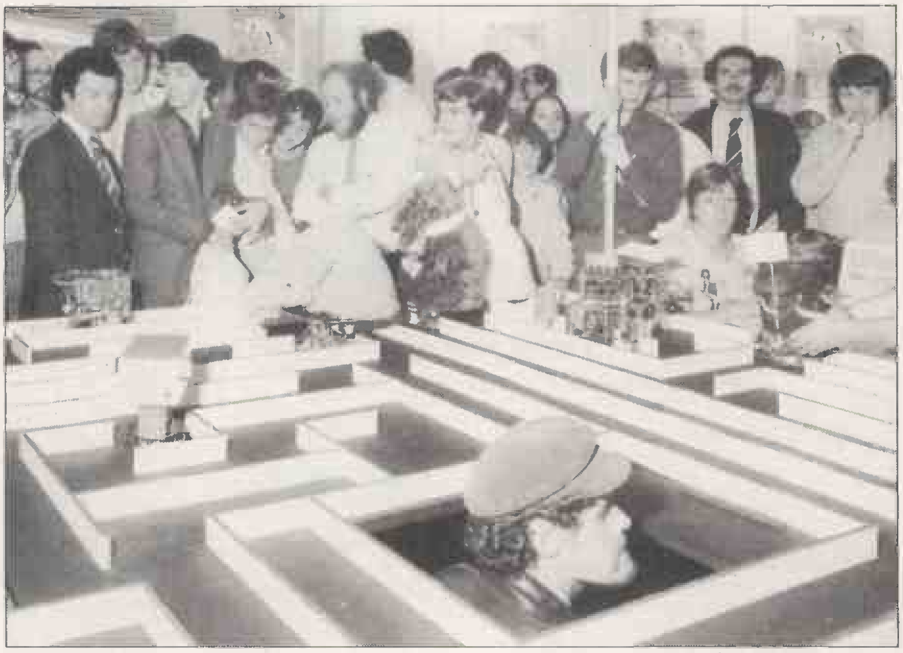
HEAVY METAL MICKEYS

Bill Bennett rounds up the latest news of the front-running competitors in this year's race of the rattling rodents.



THE BRITISH HEAT of the Micromouse competition is being held at the Computer Fair, in Earls Court on April 23-25. The competition is all the hotter this year as successful entrants will be contesting for the chance to go to the Israeli port of Haifa for the finals of Euromouse '82. A place in the sun is not the only incentive, nor is the usual glittering array of prizes: the real prize is the satisfaction of knowing that your mouse is at the forefront of its species, a cybernetic rodent.

More competitors

This year the competition will feature an extra competition for school entries, with a separate prize. Micromouse organiser John Billingsley of Portsmouth Polytechnic will once again be in command and he expects a larger number of entrants than the 20 who showed at Wembley last year. Provision has been made for last-minute entries, though they may have to pay for their procrastination by a penalty.

Current Micromouse champion, Thumper, and his human "minder" Dave Woodfield are currently favourites to take the laurel crown once more. However they could be in for some stiff competition. Dave Woodfield's mouse fairly flew around the maze last time out and managed a best time of only 45 seconds. The next best was a leisurely 1 minute 15 seconds. In his haste Thumper certainly lived up to his name, banging his head against the wall faster than you can say "heavy metal". This caused some consternation among rival competitors, but the sheer margin of his victory left the result beyond dispute.

Champion 1981: Dave Woodfield with Thumper

Secrets revealed

The main challenger to Thumper is Nick Smith with good old Sterling Mouse. Nick is the man who once ruled supreme in Micromouse circles until he told everyone all his secrets in *Practical Computing*. Rumour has it that Sterling is now running on 24V. The new high-powered Sterling will be whizzing about in a cloud of sparks, providing the audience with someone to cheer on.

The other two fancied runners are Quaestor, now in training at the Andrew Buckly stables, and the notorious Thezeus team. Thezeus was the first mouse to appear based on the ZX-80 microcomputer. With the touch-sensitive keyboard sawn off, Thezeus is a striking mouse; together with the Son of Thezeus it featured for a while in these pages. Alan Dibley, owner of the Thezeus Micromouse empire, has come up with a third model known by some as Yetanotherzeus or T3.

Also expected to be turning up are Gloria, Marvin, Dreamy Mouse, Ramouse 2, and Major Tom the quaintly-named cybernetic pet of Adrian Dickens, representing Cambridge.

Smuggling their mice through customs to avoid quarantine regulations will be a number of Continental contestants. Peter Watson, one of our men in Brussels and Klaus Gerber of Munich represent the European nature of the competition.

Micromice will be on show throughout the three days of the Computer Fair, the first two days being taken up with various eliminations. On Saturday afternoon it is likely that a separate final for the school entries will be staged and the grand final will take place on the Sunday in front of the distinguished judges.

Contender 1982: Nick Smith with Sterling Mouse.

Computers in Farming, Milestone or Millstone?

By T Rehman and R J Esslemont. Published by the Farm Management Unit, University of Reading, Earley Gate, Whiteknights Park, Reading, Berkshire. 70 pages, £2.50.

THIS BOOKLET is a serious attempt to give farmers some idea of what computing might do for their business, and what the costs and difficulties are likely to be. The authors cover the ground quite thoroughly and sensibly. The pros and cons are debated of bureaux services versus a personal micro — and if the latter is chosen, of home-written software over packaged products.

The field is confused, with no simple answers either in hardware or software, and inevitably the material reflects these difficulties. The authors do the best they can, but one wonders how accessible even a slim work like this will be to busy, pragmatic farmers. Still, it is hard to think of better advice that could be given on paper to someone who probably has never seen a computer. If farmers still find things difficult, they are no worse off than the rest of us.

Peter Laurie

Simple Pascal

By James J McGregor and Alan H Watt. Published by Pitman 182 pages.

ALTHOUGH PASCAL is an easy language to teach to novices it can present problems to programmers converting from Basic or Cobol, for example. Having to unlearn old habits seems to be more difficult than starting from scratch. This book offers an approach to Pascal which could be useful since it concentrates exclusively on the most elementary parts of the language.

The book starts from an example program, and then throughout continues to use examples more liberally than any other Pascal text I have encountered. This alone would make it a useful adjunct to the more standard texts which are too often deficient in this respect. Among a number of particularly welcome features is the use of an If statement to guard against the selector in a Case statement not referring to one of the labels. The more general problem of data validation is mentioned. Later in the text stepwise refinement is briefly presented.

The reservations I have about this book centre on the fact that it misses out all the data-structuring features which are most central to the language. The novice learning from this book therefore fails to develop competence in those aspects of the language which give it its greatest advantage over other languages — Basic in particular. Comprehensiveness has been sacrificed for simplicity.

As a supplementary text this book will be useful to novices. As a main text for learning the language it is inappropriate to novices, but could provide some support for Basic programmers having difficulties with Pascal syntax.

J Cookson

The Joy of Minis and Micros

By P G Stein. Published by Hayden. 200 pages. £8.55. ISBN 0 8104 515 65

ADVICE to both those about to embark on computerisation for the first time and the existing user who has run into difficulties, is the aim of this book. Unfortunately if such a reader attempted to read it from cover to cover he would become even more confused.

The Contents page suggests that the book is completely conventional, listing as it does a series of chapters on the options, how to make the right choice and how to use a small computer. All very normal until you start to read, and it rapidly becomes apparent that this book is no more than a small amount of new text to link, very loosely, a collection of old magazine articles. The result has only the barest suggestion of a structure and is therefore both confusing and a very uncomfortable read.

As the book is so unstructured and general, it is almost impossible to describe its contents briefly. However, it does provide sections on the differences between mini and mainframe computers and how they might be utilised, and there are articles on computer languages and how to link to other devices. Games and applications from microbiology to image enhancement are discussed, as are the workings of hardware and software.

Each chapter has an introduction followed by a stream of unrelated articles separated only by their titles, but only a few of them have any indication of when they were first published. There is nothing to recommend the verse which occasionally attempts to lighten the going, although there is some wit in the rest of the writing.

It is a shame that more effort was not put into this book as much of the advice is very valuable. Most of the articles refer to minicomputers, and where microcomputers are mentioned they are regarded as being rather limited in scope. It then becomes clear that the articles are several years old — they are all apparently from before early 1978, which is a very long time ago in terms of the development of the small computer.

Conclusions

- **This book contains sound advice which is masked by the lack of structure and the dated facts.**
- **While aimed at the unsophisticated reader it is so superficial in many areas that it will not untangle confusion but add to it.**
- **It cannot be recommended as it is now nearly four years out of date, despite its 1981 copyright date.**

Martin Wilson

A Primer on Pascal

Second edition, by Richard Conway, David Gries and E Carl Zimmerman. Published by Winthrop. 430 pages. £9.70.

PASCAL HAS usually been used as a second, more developed language for professionals and, more recently and in fewer numbers, private users. It is a compact language, modular in concept and machine-efficient.

So why do non-professional users tend to flinch at the mention of its name and professionals think of reasons to use something else? Its inherent complexity tends to be unforgiving, which means that greater effort is required to analyse what is to be done before beginning to program. With the inclusion of a Pascal option on most popular machines, including Apple, a way of acquiring Pascal competence has to be found.

Conway, Gries and Zimmerman set themselves two tasks: to explain the elements of programming in general and to teach Pascal as a first language. The book is intended to be used by people without much knowledge of systems analysis and problem definition. Hence the authors assume that their readers need to be led gently over this ground without being frightened.

The primer does not claim to cover all the nuances and all the possibilities of the language. An introductory chapter concentrates on problem analysis, but the complete beginner in such matters may need further help before becoming an instant systems analyst.

Chapter 4 is devoted to problem-solving and design considerations relating to programs. Few of us, on buying a machine possessing an instruction manual, acutually read the thing until we get stuck, so it may well be that this order is more useful than the conventional one of dealing thoroughly with each subject in turn.

The book is remarkably easy to read. It begins with a series of small programs aimed at those who always intend to read the instructions before opening the carton. It shows what the result of using Pascal looks like, and leads progressively and persuasively into Pascal rules, the conventions of which are well presented.

Conclusions

- **The systematic use of Pascal routines provides a clear, stepwise introduction to the subject.**
- **This book, in conjunction with a computer's own manual, should enable determined students to find their way round the language. The program-validation and fault-finding sections are to the point and realistic.**
- **The presentation of the book, via word processor, is simple, neat and agreeable to handle and to use.**

David Wilshere

Beating the betting levy

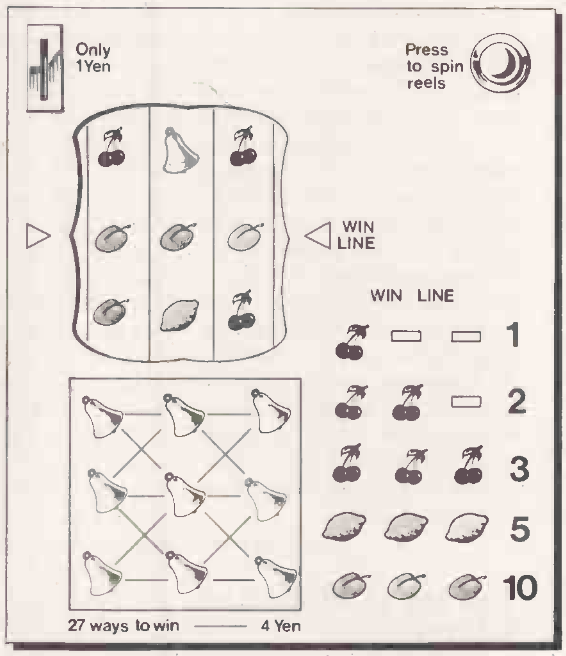
ON THE one-arm bandit at the Knotty Ash Cybernauts Social Club there are three reels. Until last week it was returning a handsome profit, as well as keeping the inmates happy with their winnings — especially as the bells give a prize of 4 yen even if they are only adjacent to the win line. However, last week the Knotty Ash

by Tony Roberts

Thingwall imposed a 14 percent levy on all stakes, which was more than the average profit on the machine.

The problem was solved by one of the barmaids who noticed that by changing just one symbol the machine began to make a profit again, though only one-third of the old profit. Curiously, the new average profit is exactly the same as the average loss it had begun to incur.

What was the change?



Winnings:
3 plums = 10
3 lemons = 5
3 cherries = 3
2 cherries = 2
1 cherry = 1
A Bell anywhere on each reel = 4

The three reels are:

1	2	3
cherry	plum	bell
cherry	cherry	cherry
plum	plum	plum
bell	cherry	cherry
lemon	lemon	plum
bell	bell	cherry
lemon	lemon	lemon
cherry	plum	cherry
cherry	lemon	lemon
cherry	bell	cherry

Solution to March puzzle

AT THE ALTERNATIVE Technology (Computing) Fair the Audromeda was solar powered and the Epsilon produced its output through a VDU.

Norman Kirkby starts at rock bottom with an explanation of how the central processor in your micro builds simple numerical codes into complex arithmetic operations. Using the built-in assembler program of the Acorn Atom, he takes you step by step through the principles of assembler mnemonics, which put the power and speed of machine-code programs at your fingertips.

More basic than Basic

HEXADECIMAL NUMBERING is merely a method of expressing a number in a different form from the familiar decimal method. The value of the number is not changed. Hexadecimal, commonly abbreviated as "hex", uses the symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F and is based on multiples and powers of 16 rather than the 10 of the decimal system.

Hex 0F is equivalent to decimal 15; hex 10 is equivalent to decimal 16; and hex FF to decimal 255, etc. Hex is used because it is often more convenient than decimal when expressing machine code and, in the Acorn Atom, when referring to memory addresses. Because a set of numerals could be taken for either hex or decimal numbers, a symbol is used to identify numbers in hex. On many machines it is a "$", but on the Atom it is a "#", and that will be used here.

Experts will quarrel over precise definitions of a machine-code program but the one suited to this article runs as follows: "A machine-code program is a list of numbers, called codes, some of them instructions, some items of data, and some memory addresses".

The micro takes each code in turn and obeys it if it is an instruction, processes it if it is data, or visits it if it is a memory address. Note that the program is simply a list of numbers, as in programs 1 and 2.

The full name for each number is "operation code", often shortened to "op code". Each number is stored in a memory location with the next number in the immediately following location. In eight-bit computers each code must be smaller than 255 (#FF) since that is the largest number which can be stored as eight bits. Nevertheless, 255 is ample to provide a powerful instruction set.

Program 1	Program 2
#A9	#A9
#07	#07
#18	#18
#65	#6D
#90	#00
#85	#82
#91	#8D
#60	#01
	#82
	#60

Machine-code programs 1 and 2

There are differences between different microprocessors. What is described here refers to the 6502 microprocessor which is used in the Atom, Pet, UK 101, Apple and the basic BBC Micro among others, but not the ZX-80 or ZX-81, nor the TRS-80 series.

The main work is done in the accumulator which is an eight-bit register. A register is like a memory location — it has eight-bits — which it is located in the microprocessor chip. Unlike other registers, the accumulator has a carry bit and various other friends in a status register. There is also an X register and a Y register.

The Accumulator, and the X and Y registers, can be loaded with an eight-bit number. With a little help from its friends the accumulator can transfer a number to or from a memory location or to or from the X or Y registers; it can add a number in a specified memory location to its own

(continued on next page)

Table 1. Operation code and mnemonics for single-byte addresses.

Meaning	Machine code (hex)	Mnemonic (Atom)	Mnemonic (others)
Load the accumulator with the next code	A9	LDA @	LDA#
Load the accumulator with the contents of the location whose address is the next code	A5	LDA	LDA
Add to the contents of the accumulator the contents of the memory location whose address is the next code	65	ADC	ADC
Store the contents of the accumulator in the memory location whose address is the next code	85	STA	STA
Clear the carry	18	CLC	CLC
Return	60	RTS	RTS

(continued from previous page)
contents; it can compare its own contents with those of a specified memory location; and it can do other clever things too. Some of the simpler instructions are shown in table 1.

These instructions can be used to form a simple machine-code program, for example to add 7 to a number that is stored in memory location #90, and then store the result in location #91. Non-Atom users can choose their own locations but the addresses should be less than #FF for the moment. The following are the steps to be carried out:

- Load the Accumulator with the number 7.
- Clear the carry.
- Add the contents of memory location #90 to the accumulator's contents.
- Store the result in location #91.

It is sufficient for our purposes to state that you have to clear the carry before adding.

Program 1 is the machine-code program, built up by referring to table 1. Having decided on the program, it must be entered into memory so that the computer can get to work on it. This can be done by entering the following program — program 3 — in the normal way:

```
 10 REM ENTCODE ATOM
 20 PRINT "ENTER EACH CODE AFTER
    EACH"
 30 PRINT "QUERY. IF CODE IN HEX
    ENTER # FIRST"
 40 I=0
 50 DO
 60 INPUT C
 70 I?#80=C
 80 I=I+1
 90 UNTIL C=999
100 END
```

If you have another 6502 machine you could try program 4, replacing S by a memory location at the beginning of 11 locations which will not corrupt the text of the listing or the operating system.

Run the program, and answer each prompt by entering the codes in program 1 in order. That is, type #A9, or use whatever is the symbol for hex on your machine, or enter the decimal equivalent for #A9. Then press Return, type #7, press Return, and so on. When you reach the end at #60 followed by Return, type 999 and the program will end. If you discover a mistake after pressing Return, type 999 and the program will abort and you can start again from the beginning. Note that 999 is not a machine code, merely a signal for the Basic program to end.

The machine-code program is now in memory, in order, starting at memory location #80 because line 70 of program 3 said so. The contents of memory location #90 must be set to a number to be added to 7. So choose 10, and set the contents of location #91 to a known value; say 0. On an Atom, execute:

?#90=10; ?#91=0

Other users will use Poke, and their own locations, and will replace the ";" by a ":".

```
 10 REM ENTCODE OTHER
 20 PRINT "ENTER EACH CODE AFTER
    EACH QUERY. IF CODE IN HEX.
    ENTER $ FIRST"
 30 FOR I=0 TO 10
 40 INPUT C
 50 IF C=999 THEN I=10 GOTO70
 60 POKE (S+I), C
 70 NEXT I
100 END
```

Program 4.

Now you must execute the machine-code program. The command for this on the Atom is Link followed by the address — #80 in this case — of the memory location holding the first code. On other machines use the appropriate code, e.g., the appropriate address for S. So execute:

LINK #80

which tells the computer: "stop thinking in Basic; start thinking in machine code; note the number after the Link command and treat it as an address; fetch the code at that location; treat it as an instruction and obey it; fetch the code in the next location; obey it if it is to be treated as an instruction, or process it if it is to be treated as data, or visit its location if it is to be treated as a memory address; and so on until you come to a memory location containing a code equal to #60 and which is to be treated as an instruction; return to your Basic program at the point where you left it and carry on with the next Basic instruction". At this point nothing appears on the screen to indicate that anything has happened, so look at memory location #91 by executing:

PRINT ?#91

i.e., Peek it, and you will find it now contains 17 — the answer to the sum 7+10. The machine-code program has worked.

A crucial question may have crossed your mind. How does the micro know whether a code is to be treated as an instruction, as data, or as a memory address? The answer lies in the preceding code. The micro follows the rule: "Unless instructed otherwise, treat each code as an instruction. If the preceding code indicates otherwise, treat the code you are considering as an item of data, or as a memory address, accordingly".

The first code is always treated as an instruction because there is never any previous code to say otherwise. The first code in program 1, #A9, when treated as an instruction, means "load the accumulator with the next code". Clearly, therefore, the next code, #7, is to be treated as an item of data, so #7 is loaded into the Accumulator. When it considers The next, third code, #18, it is treated as an instruction and means "clear the carry".

The fourth code, #65, is also treated as an instruction and means "add to the contents of the accumulator the contents of the memory location whose address is the next code". Consequently the next code is treated as an address, #90, and the instruction #65 is obeyed accordingly. The sixth code, #85, is treated as an instruction and means "store the contents of the accumulator in a memory location whose address is the next code". The seventh code, #91, is therefore treated as a memory address and the contents of the accumulator are stored in location #91. The last code, #60, is treated as an instruction — since the previous code did not say otherwise — and means "return to Basic".

Most people would agree that making up and entering a machine-code program is deadly boring, and debugging it is almost impossible. When computers were young, code was in binary and even more indigestible so, not surprisingly, someone thought of making the computer do the routine job of converting instructions into code.

They wrote a program called assembler to take instructions that were closer to English and which would generate and assemble the machine code. Clearly, the assembler instructions must use shorthand because the instructions themselves are too long, so human memory-joggers called mnemonics are used instead — see table 1. Note that the difference between the meanings of LDA@ and LDA lies in the way they treat the next code. The following program — program 5 — gives the assembler mnemonics for program 1.

```
 10 REM LIST 1 IN ASSEMBLER
 20 ?#90=10; ?#91=0
 25 PRINT "?#91="?#91'
 30 DIM P(-1)
 40 [
 50 LDA @#7
 60 CLC
 70 ADC #90
 80 STA #91
 90 RTS
100 ]
110 LINK TOP
120 PRINT "LOCATION #91 IS NOW
    "?#91'
130 END
```

However, it is not enough simply to enter the mnemonics — remember, it is only machine code that the microprocessor understands. The mnemonics must be operated on to generate the code and assemble it somewhere in memory. In listing 5, line 40 says "what you are about to receive is in assembler, not Basic"; line 100 says "Amen" to assembler and returns to Basic.

Line 30 looks odd: it does not Dim a string of −1 elements, but means "assemble the machine code resulting from the following mnemonics starting at the first free memory location after the end of this Basic program text". For a program like program 5 — i.e., one without any Dim statements other than the Dim P(−1) — that location is the third one after the last visible character, which is "D" in this case.

In the Atom, the address of that location is given a special name "Top" for convenience. Top is treated as an address, so to execute your machine-code program resulting from listing 5 you need line 110.

Line 20 Pokes the initial values for your sum into your two memory locations. Lines 25 and 120 demonstrate that the machine code has worked. Now execute New, and enter and run program 5, and you should see the contents of location change from 0 to 17.

When you ran program 3 or 4 earlier, and entered the machine code directly from the keyboard, it was executed directly from the keyboard by entering Link followed by the address of the location holding the first code. You can do the same with program 5, but first you should set the contents of location #91 back to zero by executing:

```
?#91=0
```

Now execute:

```
LINK TOP
PRINT ?#91
```

and you will see that the contents have again been changed to 17. When you ran program 3 or 4, the Link command was followed by the address of the first code expressed in the form of a number. You can do the same with program 5 by executing:

```
PRINT & TOP
```

and you will get the hex address of Top, i.e., the actual address of the location holding the first code. It is in hex, not decimal, because & instructs the Atom to print in hex. It is a two-byte number to whom we have not yet been introduced, but forget that for the moment.

Repeat the above procedure of zeroing location #91, Linking — but this time using the hex number for Top — and printing the new contents of location #91. Write down the address of Top.

You should by now appreciate that the assembler mnemonics are merely a stepping-stone to higher things, namely the generation and assembling of machine code. Once they have done that

(continued on next page)

Table 2. Operation code and mnemonics for two-byte addresses.

Meaning	Machine code (hex)	Mnemonic (Atom)	Mnemonic (others)
Load the accumulator with the contents of the location whose address is the next two codes	AD	LDA	LDA
Add to the contents of the accumulator the contents of the memory location whose address is the next two codes	6D	ADC	ADC
Store the contents of the accumulator in the memory location whose address is the next two codes	8D	STA	STA

(continued from previous page)

they are redundant. Prove this to yourself by running program 5, and Listing it. Then corrupt some of the mnemonics by replacing them with garbage of your choice. To prevent the beginning of the machine code being overwritten by any lengthening of the text of program 5, you should delete line 70 and not lengthen any of the other lines.

List it again to see what a fine mess it is, but do not run program 5 in this state. Now demonstrate the execution of the machine code by executing the three statements:

```
?#91=0; LINK #XXXX; PRINT ?#91
```

as before, where XXXX is the number of Top you wrote down. It still works, without the mnemonics.

Up to now we have been considering hex numbers no bigger than #FF or decimal 255, and which need only one byte to hold them. But of course hex numbers can be as big as you like, and you need hex numbers greater than #FF if they are to express memory addresses. A limit of #FF locations would not provide much more memory than a calculator. Because any hex number greater than #FF needs more than one byte, and because two bytes can hold numbers up to #FFFF, or decimal 65,535, and because that is ample for the RAM and ROM of a home computer, memory addresses are usually two bytes long.

Table 1 column 1 refers to "... the contents of the memory location whose address is the next code", which suggests that assembler and code cannot cope with two-byte addresses. In fact they can cope, and if you look at table 2, column 1 you will find all the instructions from table 1 that refer to addresses, except that they refer to two-byte addresses, and the codes are different. Study the following listing which produces exactly the same result as program 5, despite the fact that two-byte addresses and different codes are used. The assembly listing — the printout you get when an assembler program is run — demonstrates the change of codes. Program 6 is:

```
 20  ?#8200=10; ?#8201=0
 25  PRINT"?#8201="?#8201'
 70  ADC #8200
 80  STA #8201
120  PRINT "LOCATION #8201
     IS NOW"?#8201'
```

Since the mnemonics are identical, how does the micro know how to choose different codes for, say, STA followed by a one-byte address as in program 5, and STA followed by a two-byte address as in program 6? The answer lies in the line in the assembler part of the program text. The rule the machine follows is, in effect "when you come to a mnemonic that involves an address, look at the program text between the mnemonic and the next statement terminator — that is, the end of a line, or a semicolon in a multi-statement line in the Atom or a colon on other machines. If in that area you find a single-byte number, treat that as the whole address and choose the corresponding code for the mnemonic, following it by that single-byte number as the next code. But if there is a two-byte number in that area, treat it as a double-byte address and choose the corresponding code, followed by the two-byte number as the next two codes, low byte first".

0	82	20	45	4E	44	D	FF
A9	7	18	65	90	85	91	60

Figure 1. Machine-code display.

Program 1 is the code produced by program 5, and program 2 is that produced by program 6.

To examine the machine code after it has been assembled, run program 5 and execute:

```
@ =4; FOR I=TOP−8 TO TOP+7; PRINT
&?I; NEXT
```

It sets the number of spaces for each printed number to 4 — @ has a different meaning in this context. The Print statement is a Peek, and it prints in hex the contents of memory locations from 8 before Top to 7 after Top. You should see the display shown in figure 1.

The contents of Top−8 are at the top, left-hand corner, and the contents of Top are at the beginning of the second line. If the third to the sixth numbers in the first line, 20 to 44, are treated as ASCII codes they spell:

space END

which is the end of the text of program 5. The D and FF are hex numbers which the Atom always uses to signify the end of the text of a Basic program. The first two 0 and 82, are the line number in hex — decimal 130. This demonstrates that the machine code is assembled starting at the first free byte after the program text, as was mentioned earlier.

If the program contains Dim statements other than the Dim P(−1) for the assembler, the space for the string and/or array elements is reserved beginning at Top, with the first machine code being assembled in the location immediately after the last byte of the last string or array element.

You need not assemble the machine code after the program text if you do not want to. To assemble it starting at another address of your choice, replace lines of program 5 with:

```
 30 P = #8300
110 LINK #8300
```

or with:

```
 30 P = #2A00
110 LINK #2A00
```

Run the program and check that it performs as before. You could also carry out a memory dump using location #8300 or #2A00 to confirm that the code has been assembled there. This procedure is useful if you want to put the mnemonics temporarily in another part of memory.

BUYERS' GUIDE SOFTWARE

Software packages are listed by application, in alphabetical order, with the systems on which each package will run also listed alphabetically. The guide is not exclusively for business applications: if your company is the source or dealer for a package with a more unusual application, send us the details and we will create a new category.

The usual criteria have been applied. The minimum configuration is 32K of RAM, a disc and a printer; the price of the package must lie between £50 and £1,000; the companies listed are the source of the software or the main dealers in the U.K., and the capacity quoted is per disc or drive.

Machine type by application

Combined Ledger/Stock/Invoicing

Machine type	Supplier name	Price	Capacity
Apple II	Vlasak Electronics Ltd	£855	1,500 a/c 5,000 trans
Apple II	Dataforce (U.K.) Ltd	£855	
Apple II	Microsense Computers Ltd	£340	
Apple II	Southern Computer Systems	£1,000	varies
Apple II/ITT	Informex London Ltd	£298	500 a/c
Apple II	Star Systems Ltd	£750	2,000 a/c 6,000 trans
Commodore 3032	Compfer Ltd	£400	varies
Commodore 3032	Analog Electronics	£550	
Commodore 3032	Logma Systems Design	£600	1-6 shops
Commodore 3032	Grama (Winter) Ltd	£475	varies
Commodore 3032	Bristol Software Factory	£300	1,000 a/c 6,000 trans
Commodore 3032	Compfer Ltd	£600	500 a/c 1,000 items
Commodore 3032	HB Computers	£695	500 a/c 2,500 trans
CP/M	D T Systems	£750	varies
CP/M	Wisbech Computer Services	£900	varies
CP/M	Graffcom Systems Ltd	£400	varies
CP/M	Benchmark CS Ltd	£950	varies
CP/M	Computastore Ltd	£1,000	
CP/M	Interface Computer Services	£350	
CP/M	Minicomputer CS Ltd	£1,250	varies
CP/M	Salmon Microcomputing	£750	1,600 items 1,000 trans
CP/M	Selven Ltd	£1,500	3K a/c 7K trans
CP/M	Map Computer Systems	£1,000	varies
CP/M North Star	Instar Business Systems	£999	600-2,900
CP/M North Star	Criterion Business Systems		
North Star DOS	Inteligent Artefacts	£510	1,500 a/c 5K trans
Ohio Scientific	Microcomputer BM	£656	
Ohio Scientific	Stratheden Ltd		
Tandy Model 2	Chess Consultancies	£1,200	
Tandy Model 2	Chess Consultancies	£995	5,000 items 1,500 a/c
Tandy TRS-80	Microcomputer Applications	£90	
Tecs	Jar Software Systems	£650	500 a/c 300 nom. a/c

SHOPWINDOW

Database Managers

Machine type	Supplier name	Price	Capacity
Apple II	ACT Microsoft Ltd	£75	
Apple II	Courtman Micro Systems	£106	100K characters
Apple II	Keen Computers	£425	up to 70Mbytes
Apple II/ITT	Systematics International Ltd	£72	
Apple II/ITT	Diskdean Ltd	£120	varies
Apple II/ITT	Systematics International Ltd	£125	1,000 references
Apple II/ITT	Informex London Ltd	£198	500-1,200 records
Apple II/ITT	The Software House	£140	900 records
Commodore 3000/8	Stage One Computers	£45-£250	650-2,400 records
Commodore 3000/8	Commodore BM (U.K.) Ltd	£150-£300	650-1,400-64,000 records
Commodore 3032	CPS (Data Systems) Ltd	£200	varies
Commodore 3032/8	Compsoft Ltd	£190	600-5,000 records
Compucorp	Verwood Systems	£375	
CP/M	Compsoft Ltd	£400	30,000 records
CP/M	Great Northern CS Ltd	£110-£210	and varies
CP/M	Microtek Computer Services	£250-£500	
CP/M	Cleno Computing Services	£90-£325	varies
CP/M	Interface Ltd	£200	varies
CP/M	Median-Tec Ltd	£500	
CP/M	Microbits	£145	varies
CP/M	Southdata Ltd	£650	up to 8Mbytes
CP/M SWTPC	Verwood Systems		
Metrotech System	Metrotech	£200-£1,000	
Ohio Challenger	U-Microcomputers Ltd	£175	
Ohio Scientific	Microcomputer BM	£175	
Superbrain	Alan Pearman Ltd	£295	varies
SWTPC	SWTPC	£100	
Tandy TRS-80	Cleartone ADP	£75	varies
Tandy TRS-80	ACT Microsoft Ltd	£75	
Z-80/8080	Structured Systems Group	£135	varies
Z-80/Cromemco	Xitan Systems Ltd	£850	4,000 records/disc

Engineering Design Systems

Machine type	Supplier name	Price	Notes
Apple II	Haden Young Ltd	From £50	Provide a comprehensive series of software for building/engineering
Apple II	James C Steadman	£200	Erect concrete columns
Apple II	James C Steadman	£250	Multibay frames
Apple II/ITT	Aerco-Gemsoft	£175	Pipeline engineering
Commodore	Ismail CAD	varies	Provide a range of software for building/engineering.
Commodore 3032	Micro Computation	£300	Building-conversion specification
Commodore 3032	The Alphabet Co	£75	Time study and analysis
Commodore 3032	Comac Systems	£400	Asset register
Commodore 3032/8	Comac Systems	£400	Maintenance plan
Commodore 3032/8	Comac Systems	£400	Work orders
Commodore 3032/8	Comac Systems	£400	Plant history
Commodore 3032/8	Comac Systems	£400	Manpower analysis
CP/M	Median-Tec	£500	Plastic portal frames
CP/M	Median-Tec	£500	Slope-stability analysis
CP/M	Median-Tec	£500	Retaining wall design
Equinox	Equinox	£500	Civil/structural engineering design
Hewlett-Packard	CSC (Northern) Ltd	from £200	Engineering design systems.
Tandy TRS-80	Chess Consultancies	£450	Production planning
Tecs	Jar Software	£600	Production analysis

Estate Agents' Systems

Machine type	Supplier name	Price	Notes
Apple II	Atlanta	£750	
Apple II	Microsense	£500	
Apple II/ITT	Cyderpress	£650	

Apple II/ITT	Systematic	£850	
Commodore 3032	Stage One Computers	£250	
Compucorp	Verwood systems	£700	Estate sales
Compucorp	Verwood systems	£1,200	Estate management
CP/M	Selven Ltd		Estate agents' sales and selection
Sharp MZ-80K	Wisbech Computer Services	£195	

Financial Systems

Machine type	Supplier name	Price	Notes
Apple II	Microdigital	£200	Sales analysis
Apple II	Microdigital	£130	Credit control
Apple II	Microsense	£194	Cashier retail/ wholesale
Apple II	PK Microsystems		Solicitors' accounts
Apple II	Dataforce	£80	Cashflow projection
Apple II	Informex	£98	VAT system
Apple II	Southern Computer Systems	£750	Financial controller
Apple II/ITT	Microsense	£125	VisiCalc
Apple II/ITT	Systematics	£295	Financial planning
Apple II/ITT	Systematics	£1,000	Financial controller
Apple II/ITT	Microsense	£75	Modelling desktop plan
Commodore 3000	Stage One Computers	£250	Financial acounts package
Commodore 3000/8	ACT Microsoft	£125	Financial modelling
Commodore 3032	Stage One Computers	£100	Quote processing
Commodore 3032	CPS	£575	Invoice-costing/ jewellers
Commodore 3032	L & J Computers	£90	Cash book
Commodore 3032	ACT (Petsoft)	£150	Financial planning
Commodore 3032	Stage One Computers	£100	Bank a/c reconcile
Commodore 3032	Logma Systems	£600	Sales/analysis
CP/M	Bytesoft	£95	Financial modelling
CP/M	Micromedia	£1,000	Invoice disc factoring
CP/M	Graffcom System	£400	Hire-purchase system
CP/M	MAP Computers	£550	Financing system
CP/M	Microtek	£500	Accounting
CP/M	Microtek	£750	Budget control
CP/M	Median-Tec	£500	Financial analysis
CP/M	Graffcom Systems	£450	Purchasing system
CP/M	Business Solutions	£395	Mars
CP/M Vector	Taylor Microsystems	£390	Cashflow forecasting
Durango F-85	Kesho Systems	£1,000	Time recording/ ledger
Superbrain	Alan Pearman Ltd	£315	Financial planning
Tandy TRS-80	Chess Consultancies	£800	Sales statistics
Tandy TRS-80	A J Harding	£125	Financial balancing
Z-80/8080	Intereurope	£500	Financial modelling
Z-80/8080	Graham Dorian	£325	Sales analysis retail

General Ledger

Machine type	Supplier name	Price	Capacity
Apple II	Computech Systems	£295	500 a/c 1,700 trans
Apple II	Dataforce (U.K.) Ltd	£225	200 a/c 1,000 trans
Apple	Style Systems Ltd	£250	1,000 a/c, 2,000 postings
Apple II	Southern Computer Systems	£750	1,000 a/c 12 branches
Apple II/ITT	Systematics International Ltd		
Apple II/ITT	Guestel Ltd	£300	200 a/c
Commodore 3032	Bristol Software Factory	£300	1,000 a/c 6,000 trans
Commodore 3032	Analog Electronics	£450	
Commodore 8000	Commodore BM (U.K.) Ltd	£300	600 a/c 3,000 trans
Compucorp	Verwood Systems	£250	
CP/M	Wisbech Computer Services	£300	
CP/M	Business Solutions Ltd	£390	varies
CP/M	Bytesoft	£690	varies
CP/M	PR Daly & Co Ltd	£500	
CP/M	Haywood Associates Ltd	£500	
CP/M	Median-Tec Ltd	£500	500 a/c 5,000 trans
CP/M	Ludhouse Ltd	£500	200 a/c 5,000 trans

CP/M	Computastore Ltd	£500	999 a/c 99 centres nine computers
CP/M	Great Northern CS	£345	250 a/c
CP/M	Selven Ltd	£400	1,000 a/c 3,000 trans
CP/M	Interface Computer Services	£350	varies
CP/M	Microbits Ltd	£500	varies
CP/M	Map Computer Systems	£300	250 a/c 3,500 + trans
CP/M North Star	Benchmark CS Ltd	£250	150 a/c 500 trans
Horizon	Claisse-Allen Computing	£500	999 a/c 99 entries, nine computers
North Star DOS	Intelligent Artefacts Ltd	£295	1,500 a/c 5,000 trans
Ohio Scientific	Stratheden Ltd	£500	varies
Tandy Model 2	Chess Consultancies Ltd	£400	1,000 a/c
Tandy TRS-80	Tridata Micros Ltd	£225	500 a/c 1,800 trans
Z-80	Liveport Ltd		
Z80/8080	Solitaire	£500	Up to 26 by 400 a/c
Zilog MCZ range	Microbits	£500	100 a/c 5,000 trans

Hotel and Travel Packages

Machine type	Supplier name	Price	Notes
Apple II	Dataforce	£525	Hotel management
Apple II	Informex Logic	£298	Travel agents' system
Apple II	Informex Logic	£298	Hotel administration system
Apple II/ITT	Guestel Ltd	£500	Hotel billing
Apple II	Diskwise Ltd	£695	Hotel reservation and guest billing
Commodore 3000	Landsler Software	£350	Hotel guest billing

Incomplete Records

Machine type	Supplier name	Price	Capacity
Apple II/ITT	Padmede Computer Services	£450	900 a/c 2,000 trans/disc
Apple II	Keen Computers	£580	up to 70Mbytes
Apple II	Southern Computer Systems	£750	500 a/c 2,000 trans
Commodore 3032	Stage One Computers	£750	500 centres 2,300 a/c
Commodore 3032	Micro Computation	£555	120 a/c 5,000 trans
CP/M	Wisbech Computer Services	£750	
CP/M	CPL Ltd		250 headings, 2,000 trans per 5.25 disc
CP/M	Benchmark Ltd	£975	
CP/M	Bytesoft	£250	3,000 trans
CP/M	Criterion Business Systems	£375	2,500 entries
CP/M	Ludhouse Ltd	£1,000	variable
CP/M	Salmon Microcomputing	£950	5,000 entries
CP/M	Map Computer Systems	£550	
Durango F-85	Kesho Systems	£1,000	
Exidy Sorcerer	Basic Computing	£350	See also Micropute
Tandy Model 1	A J Harding (Molimerx)	£150	1,200
Tandy Model 1	Quickmet	£785	300 a/c 2,000 trans
Tandy Model II	IBIS Business Info Systems		9,000 a/c codes

Job Costing/Billing

Machine type	Supplier name	Price	Capacity
Apple II	Informex London	£498	1,000 emp-pro-exp codes
Apple II	Deltic Computing Ltd	£250	
Apple II	Southern Computer Systems	£750	
Apple II/ITT	Padmede Computer Services	£300	999 clients 99 rates
Apple II/ITT	TABS Ltd	£99	100 jobs 3,000 trans
Commodore 3032	CSM Ltd	£600	1,000 jobs 100 people
Commodore 3032	Stage One Computers	£100	300 appointments
CP/M	Business Solutions Ltd	£190	varies
CP/M	Map Computer Systems Ltd	£550	400-96,000 jobs
CP/M	Graffcom Systems Ltd	£400	varies
CP/M	Ludhouse Ltd	£1,000	1,000 jobs 35 codes
CP/M	Microtek Computer Services	£1,000	
CP/M	Great Northern CS Ltd	£455	300 clients
CP/M	Salmon Microcomputing	£300	225 codes
CP/M	CPL Ltd	£300	
CP/M	Goldcrest	£200	
CP/M North Star	Intelligent Artefacts	£275	

Mailing Systems

Machine type	Supplier name	Price	Capacity
Apple II	Keen Computers Ltd	£300	500 addresses
Apple II	SBD Consultants Ltd	£55	
Apple II	Microsense Computers Ltd	£70	
Apple II	Informex London Ltd	£198	
Apple II	Atlanta	£55	1,000 names and addresses
Apple II	Keen Computers	£495	32,767 records
Apple II/ITT	Systematics International Ltd	£300	500 addresses
Apple II/ITT	The Software House	£57	750 names and addresses
Apple II/ITT	Personal Computers Ltd	£50	400 entries
Commodore 3000/8	Amplicon MS Ltd	£145	1,500-4,000 records
Commodore 3032	MMS Computer Systems	£250	3,000 records
Commodore 3032	Stage One Computers	£100	325 records
Commodore 3032/8	Compsoft Ltd	£190	13,000
Compucorp	Verwood Systems	£250	
CP/M	Goldcrest	£200	
CP/M	Compsoft Ltd	£400	27,000
CP/M	Structured Systems Group	£50	varies
CP/M	Graffcom Systems Ltd	£250	800-5,000 records
CP/M	Median-Tec Ltd	£500	
CP/M	Microbits	£230	varies
CP/M	Interface Computer Services	£200	varies
CP/M Horizon	Microtek Computer Services	£250	varies
CP/M North Star	Intelligent Artifacts	£250	
CP/M North Star	Micromedia Systems	£195	
CP/M Vector	Taylor Microsystems	£375	
North Star	Intelligent Artifacts	£250	
North Star Horizon	Wisbech Computer Services	£195	1,200 per disc
Tandy TRS-80	A J Harding (Molimerx)	£55	600-3,750 records
Tandy TRS-80	Comput-A-Crop	£78	varies
Z-80/8080	Intereurope SD Ltd	£200	30,000 entries
Z-80/8080	Micro Focus	£90	varies

Order Entry/Invoicing

Machine type	Supplier name	Price	Notes
Apple II	Informex	£198	Invoicing system
Apple II	Southern Computer Systems	£750	Invoicing
Commodore 3032	MMS Computers	£250	Order control
Compucorp	Verwood Systems	£250 each	
CP/M	Wisbech Computer Services	£600	
CP/M	Graham-Dorian	£500	200 invoices 1,500
CP-M	Goldcrest	£300	Invoicing
CP/M	PR Daly & Co	£200	Invoicing
CP/M	Graffcom Systems	£350	Order entry/invoicing
CP/M	Interface Ltd	£250	Invoicing
CP/M	Median-Tec		Invoicing
Tandy TRS-80	Tridata Micros	£75	Invoicing
Z-80/MCZ	Software Architects	£600	Order entry/invoicing

Payroll

Machine type	Supplier name	Price	Capacity
Apple II	Dataforce (U.K.) Ltd	£375	
Apple II/ITT	TW Computers Ltd	£145	
Apple II/ITT	Informex London Ltd	£298	
Apple II/ITT	Algobel Computers	£295	500 employees
Apple II/ITT	Vlasak Electronics Ltd	£375	200 employees
Apple II/ITT	Computech Systems	£379	300 employees
Apple	Style Systems Ltd	£350	450 employees
Apple II/ITT	Tabs Ltd	£99	50 weekly 100 monthly
Commodore 3000/8	Commodore BM (U.K.) Ltd	£150	200-600 employees
Commodore 3000/8	Landsler Software	£150	200-500 employees
Commodore 3032	Analog Electronics	£90	
Commodore 3032	L & J Computers	£220	
Commodore 3032	Intex Datalog Ltd	£195	200 employees
Commodore 3032	Computastore Ltd	£75	483 employees
Commodore 3032	ACT (Petsoft) Ltd	£195	600 employees
CP/M	Benchmark CS Ltd	£350	300 employees, 50 departments
CP/M	Haywood Associates Ltd	£350	

CP/M	Median-Tec	£500	1,000 employees
CP/M	Salmon-Microcomputing	£300	500 employees
CP/M	Map Computer Systems	£350	300-96,000 employees
CP/M	Daman Computer Services	£900	1,000 employees/ Mbyte
CP/M	Selven Ltd	£500	400 employees
CP/M	PR Daly & Co Ltd	£350	
CP/M	Graffcom Systems Ltd	£500	500 employees
CP/M	Horizon Software Ltd	£500	
CP/M	PCL Software Ltd	£495	1,200 employees
CP/M	Ludhouse Ltd	£450	300 employees
CP/M	Comput-A-Crop	£495	175 employees
CP/M	Microbits	£500	varies
CP/M North Star	Micromedia Systems	£495	350 employees
CP/M North Star	Intelligent Artefacts	£52	100 employees
CP/M Vector	Taylor Micro Systems	£490	
Durango F-85	Kesho Systems	£500	
Horizon	Claisse-Allen Computing	£500	250 employees
Ohio Scientific	Stratheden Ltd	£750	varies
Sharp MZ-80	Tridata Micros Ltd	£250	400 employees
Tandy TRS-80	A J Harding (Molimerx)	£120	
Tandy TRS-80	Chess Consultancies	£400	400 employees
Tandy TRS-80	FIBS	£429	
Tandy Model 2	P J Norris	£500	1,000 per disk
Tandy TRS-80	Tridata Micros Ltd	£218	400 employees
Tandy TRS-80	3-line Computing	£140	
Tecs	Jar Software Systems	£250	300 employees
Z-80/8080	Liveport Ltd	£250	500 employees
Z-80/8080	Solitaire	£500	200 employees
Zilog MCZ range	Microbits	£500	300 employees

Personnel and Administration

Machine type	Supplier name	Price	Application
Apple II	Informex Logic	£198	Personnel records
Apple II	Informex Logic	£298	Staff selection tests
Apple II/ITT	Informex Logic	£298	Employment agency system
Apple II/ITT	Informex Logic	£198	Medical records
Apple II/ITT	Informex Logic	£198	Hospital administration
Commodore 3000	Intex Datalog Ltd	£100	Hospital administration
Compucorp	Verwood Systems	£250	
CP/M	Median-Tec Ltd	£1,500	Employment agency system
CP/M North Star	Micromedia	£595	Personnel records
CP/M Vector	Taylor Microsystems	£390	Piece work
Z-80/8080	Intereurope	£500	Personnel records

Property Management

Machine type	Supplier name	Price	Capacity
Apple II/ITT	Cyderpress Ltd	£650	
Apple II/ITT	Informex London Ltd	£298	300 entries
Apple II/ITT	Cyderpress Ltd	£650	500 properties
Apple II/ITT	Algobel Computers Ltd	£650	400 properties
Commodore 3032/8	Compsoft Ltd	£190	13,000
CP/M	Compsoft Ltd	£400	27,000
CP/M	Algobel Computers Ltd	£650	2,000 trans
CP/M	Salmon Microcomputing	£900	
Z-80/8080	Graham Dorian Software	£325	varies

Purchase Ledger

Machine type	Supplier name	Price	Capacity
Apple II	Dataforce (U.K.) Ltd	£315	200 a/c 1,000 trans
Apple II	Logic Box Ltd	£490	400 a/c 1,000 trans
Apple II	Deltic Computing Ltd	£250	1,000 trans
Apple II	Computech Systems	£295	500 a/c 1,600 trans
Apple II	Southern Computer Systems	£750	variable
Apple II/ITT	Systematics International Ltd		
Apple II/ITT	Padmede Computer Services	£300	900 a/c 4,500 trans/ disc
Apple	Style Systems Ltd	£250	650 a/c 1,750 trans
Apple II/ITT	Guestel Ltd	£300	200 a/c
Commodore 3000/8	CSM Ltd	£550	1,000-2,000 a/c 6,000-10,000 trans

Commodore 3000/8	Anagram Systems	£399	200-2,000 a/c 800-16,000 trans
Commodore 3032	ACT (Petsoft) Ltd	£120	200 a/c 700 trans
Commodore 3032	Compfer Ltd	£300	1,000 trans 7,000 entries
Commodore 8000	Commodore BM Ltd	£300	600 a/c 4,500 trans
Compucorp	Verwood Systems	£250	
CP/M	CPL Ltd	£300	
CP/M	Goldcrest	£300	
CP/M	Wisbech Computer Services	£300	
CP/M	Bytesoft	£400	varies
CP/M	Business Solutions Ltd	£390	varies
CP/M	Median-Tec Ltd	£500	500 a/c 5,000 trans
CP/M	Ludhouse Ltd	£500	500 a/c 5,000 trans
CP/M	Great Northern CS Ltd	£315	500 a/c
CP/M	Structured Systems Ltd	£460	varies
CP/M	Selven Ltd	£600	1,000 a/c 2,000 trans
CP/M	Salmon Microcomputing	£350	1,000 a/c 24,000 trans
CP/M	Map Computer Systems Ltd	£300	400-96,000 a/c
CP/M	Microbits	£500	varies
CP/M	PR Daly & Co Ltd	£350	
CP/M	Computastore Ltd	£400	500 a/c 3,100 trans
CP/M	Haywood Associates	£350	
CP/M	Interface Computer Services	£350	varies
CP/M	Selven Systems	£600	500 suppliers 5,000 trans
CP/M North Star	Benchmark CS Ltd	£250	100 a/c 300 trans
Durango F-85	Kesho Systems	£500	
Exidy Sorcerer	Basic Computing	£125	See also Micropute
Horizon	Claisse Allen Computing	£500	800 a/c 2,000 trans
Ohio Scientific	Stratheden Ltd	£500	varies
Tandy Models 1 & 2	Chess Consultancies Ltd	£250	300-500 a/c
Tandy TRS-80	FIBS	£750	part of integrated system
Tandy TRS-80	Tridata Micros Ltd	£225	125 a/c 1,000 trans
Zilog MCZ range	Microbits Ltd	£500	400 suppliers 1,000 trans
Z-80	Liveport Ltd		
Z80/8080	Solitaire	£500	200 by 26 a/c

Sales Ledger

Machine type	Supplier name	Price	Capacity
Apple II	Computech Systems	£295	500 a/c 1,600 trans
Apple II	Dataforce (U.K.) Ltd	£315	200 a/c 1,000 trans
Apple II	Logic Box Ltd	£490	300 a/c 1,300 trans
Apple II	Deltic Computing Ltd	£250	1,000 a/c
Apple II/ITT	Padmede Computer Services	£300	900 a/c 4,500 trans/disc
Apple II/ITT	Guestel Ltd	£300	200 a/c
Apple II/ITT	Systematics International Ltd		
Apple II	Southern Computer Systems	£750	
Apple	Style Systems Ltd	£250	650 a/c 2,500 trans
Commodore 3000/8	Anagram Systems	£299	250-2,000 a/c 500-10,000 trans
Commodore 3000/8	CSM Ltd	£550 and £650	1,000-2,000 a/c 6,000-10,000 trans
Commodore 3032	ACT (Petsoft) Ltd	£120	200 a/c 700 trans
Commodore 8000	Commodore BM (U.K.) Ltd	£300	600 a/c 4,500 trans
Compucorp	Verwood Systems	£250	
CP/M	Wisbech Computer Services	£300	
CP/M	Goldcrest	£300	
CP/M	CPL Ltd	£300	with invoices
CP/M	Business Solutions	£425	
CP/M	Bytesoft	£400	varies
CP/M	PCL Software Ltd	£475	950 a/c
CP/M	Great Northern CS Ltd	£415	500 a/c
CP/M	Haywood Associates Ltd	£350	
CP/M	Median-Tec Ltd	£500	500 a/c 5,000 trans
CP/M	Ludhouse Ltd	£500	2,000 a/c 8,000 trans

CP/M	Graffcom Systems Ltd	£450	540-7,000
CP/M	Computerstore Ltd	£400	500 a/c 3,500 trans
CP/M	Salmon Microcomputing	£350	1,000 a/c 24,000 trans
CP/M	Selven Systems	£600	500 a/c 5,000 trans
CP/M	Map Computer Systems Ltd	£300	400-96,000 a/c
CP/M	Daman Computer Services	£900	1,500 a/c 500 trans
CP/M	PR Daly & Co Ltd	£350	
CP/M	Interface Computer Services	£350	varies
CP/M North Star	Benchmark CS Ltd	£250	200 a/c 500 trans
Durango F-85	Kesho Systems	£500	
Exidy Sorcerer	Basic Computing	£125	See also Micropute
Horizon	Claisse-Allen Computing	£500	800 a/c 2,000 trans
Tandy Models 1 & 2	Chess Consultancies Ltd	£250	300 a/c
Tandy TRS-80	Tridata Micros Ltd	£225	175 a/c 1,350 trans
Tecs	Jar Software Systems	£550	500 a/c
Z-80	Liveport Ltd		

Stock Systems

Machine type	Supplier name	Price	Capacity
Apple II	Logic Box Ltd	£490	1,200 items
Apple II	Vlasak Electronics Ltd	£150	7,000 items
Apple II	Dataforce (U.K.) Ltd	£200	850 items
Apple II	U-Microcomputers Ltd	£199	
Apple II	Microsense Computers Ltd	£100	
Apple II	Informex London Ltd	£198	
Apple II	Southern Computer Systems	£1,000	
Apple	Style Systems Ltd	£250	900-80,000 items
Apple II/ITT	Microdigital Ltd	£225	625 items
Apple II/ITT	Vlasak Electronics Ltd	£285	500 items
Apple II/ITT	Systematics International Ltd	£500	200-2,500 items
Apple II/ITT	Guestel Ltd	£300	
Apple II/ITT	Padmede Computer Services	£300	2,000 postings
Apple II/ITT	The Software House	£80	800 items
Commodore 3000	Intex Datalog Ltd	£195	2,400-3,700 items
Commodore 3000/8	Commodore BM (U.K.) Ltd		600-2,000 items
Commodore 3000/8	Rockliff Brothers Ltd	£275	3,400-10,000 records
Commodore 3032	Logma Systems Design	£600	1-6 shops
Commodore 3032	ACT (Petsoft) Ltd	£75	2,400 items 1,000 a/c
Commodore 3032	ACT Microsoft Ltd	£75	1,200-5,900 items
Commodore 3032	Anagram System	£320	500-600 items 255 a/c
Commodore 3032	L & J Computers	£60	500 items
Commodore 3032	Bristol Software Factory	£300	2,300 items
Commodore 3032	Stage One Computers	£100 and	600-650 items
Commodore 3032	SMG Microcomputers	£395-£495	2,450-7,000 items
Commodore 3032	Compfer Ltd	£350	200 lines 20 bars
Commodore 3032/8	Compsoft Ltd	£190	13,000
Compucorp	Verwood Systems	£250	
CP/M	CPL Ltd	£300	
CP/M	Goldcrest	£300	
CP/M	Wisbech	£300	
CP/M	Bytesoft	£700	2,000-8,000 lines
CP/M	Compsoft Ltd	£400	27,000
CP/M	Microtek Computer Services	£750	
CP/M	PR Daly & Co Ltd	£350	
CP/M	Great Northern CS Ltd	£375	1,500
CP/M	Haywood Associates Ltd	£350	
CP/M	Median-Tec Ltd	£500-£800	1,000 items
CP/M	Microbits	£500	varies
CP/M	Graffcom Systems Ltd	£350	350 records/disc
CP/M	Salmon Microcomputing	£400	5,000 items
CP/M	Map Computer Systems Ltd	£250	
CP/M	Ludhouse Ltd	£1,000	12,000 parts
CP/M	Interface Computer Services	£350	varies
CP/M	Selven Systems	£600	
CP/M Cromenco	Micromedia Systems	£1,000	
CP/M Horizon	Microtek Computer Services	£500-£1,000	varies
CP/M North Star	Benchmark CS Ltd	£450	350 items 275 trans
CP/M Vector	Taylor Micro Systems	£995	4,000 items/Mbyte

North Star DOS	Intelligent Artifacts Ltd	£195	
Exidy Sorcerer	Basic Computing	£125	
Tandy TRS-80	Chess Consultancies	£995	
Tandy TRS-80	A J Harding (Molimerx)	£150	1,000 items
Tandy TRS-80	Cleartone ADP	£325	4,000 items
Tandy TRS-80	Chess Consultancies	£750	500 items six sites
Tandy TRS-80	FIBS	£750	
Tandy TRS-80	Micro Gems	£150	1,000 items
Tandy TRS-80	Tridata Micros Ltd	£200-£375	630 items/disc
Tandy TRS-80	Microgems Software	£150	1,000-2,000 items
Tecs	Jar Software Services	£800	10,000 items 5,000 orders
Tecs	Jar Software Services	£850	1,000 items 300 a/c
Zilog MCZ range	Microbits	£500	2,300 items
Z-80/8080	Graham Dorian Software	£325	varies
Z-80/8080	Rogis Systems Ltd	£500	900-3,500 items
Z-80 MCZ	Software Architects Ltd	£600	varies
Z-80	Liveport Ltd		

Word Processing

Machine type	Supplier name	Price	Capacity
Apple II	Dataforce (U.K.) Ltd	£190	
Apple II	SBD Consultants Ltd	£60	
Apple II	Keen Computers	£275	up to 70Mbyte
Apple II/ITT	Systematics International Ltd	£75	
Apple II/ITT	Algobel Computers Ltd	£75	800 lines
Apple II/ITT	Personal Computers Ltd	£225-£300	200,000 characters
Commodore 3000	Stage One Computers Ltd	£125	
Commodore 3032	Dataview Ltd	£159	
Commodore 3032	ACT (Petsoft) Ltd	£325	12,000
Compucorp	Verwood Systems	£500	
CP/M	Wisbech Computer Services	£245	
CP/M	Interface Computer Services	£200	varies
CP/M	Microbits	£230	varies
CP/M North Star	Intelligent Artifacts	£250	
North Star ('c')	Intelligent Artifacts	£250	
Z-80 Superbrain	Alan Pearman Ltd	£225	

Miscellaneous

Machine type	Supplier name	Price	Capacity
Apple II	Vlasak Electronics	£30	Petrol pump losses
Apple II	Humac Ltd	£1,000	Auctioneer's package
Apple II	Humac Ltd	£600	Invoicing sales — timber
Apple II	Humac Ltd		Microfiche records
Apple II	Keen Computers	£499	Inhouse teletext
Apple II	Keen Computers	£499	Graphics
Apple	Style Systems Ltd	£750	Retail warehouse management
Apple II/ITT	Informex Logic	£198	Insurance records
Apple II/ITT	Informex Logic	£198	Time records — solicitors
Apple II/ITT	Diskwise	£198	TV rental management system
Apple II/ITT	Cyderpress	£650	Auction system
Apple II/ITT	CPR Systems Ltd	£960	Insurance brokers system
Apple II/ITT	Personal Computers	£195	Operational research
Apple II/ITT	Personal Computers	£100	Time series analysis
Apple II/ITT	Padmede Computers	£500	Insurance brokers system
Commodore 3000	Anagram Systems	£850	Media control system
Commodore 3000	Anagram Systems	£800	Slot machine monitor
Commodore 3000	The Alphabet Com	£250	Newsagent suite
Commodore 3032	Microland	£175	Printers quote system
Commodore 3032	Stage One Computers	£100	Insurance brokers system
Commodore 3032	Stage One Computers	£200	Printers job control
Commodore 3032	Commodore BM (U.K.)	£50	Appointments planner
Commodore 3032	CSM Ltd	£500	Window replacement
Commodore 3032	S A Systems	£550	Farming — office systems

SHOPWINDOW

Commodore 3032	L & J Computers	£420	Machine hire
Commodore 3032	Mandata Ltd	£1,000	Insurance brokers
Commodore 8000	Peach Data Services	£350	Library retrieval system
Commodore 8000	Peach Data Services	£550	Footware industry sales reporting
Commodore 8000	Peach Data Services	£995	Clients home accounting
Commodore 8000	Stage One	£800	General accounting package
Commodore 8000	Stage One	£330	Petaid/Wordcraft/ VisiCalc link
CP/M	Benchmark Ltd	£350	Time recording
CP/M	Bytesoft	£850	Work in progress
CP/M	Bytesoft	£150	Perpetual inventory
CP/M	Bytesoft	£850	Bill of materials
CP/M	Bytesoft	£200	Kit control
CP/M	Microtek	£500	Garage system
CP/M	PR Daly & Co	£450	Time recording
CP/M	Horizon Software	£1,000	Integrated business system
CP/M	Horizon Software	£400	Costing systems
CP/M	Research Resources	£240	Statistical analysis
CP/M	Sail	£1,000	Jewellers integrated system
CP/M	Salmon Microcomputer	£150	Appointments planner
CP/M	Selven Systems	£400	Nominal ledger
CP/M	Map Computer Systems	£450	Time recording
CP/M	Map Computer Systems	£750	Calor system
CP/M	Map Computer Systems	£425	Newsboy/newsagents system
CP/M	Haywood	£500	Time recording
CP/M	Comput-a-Crop	£1,000	Farm management
CP/M	Microtek	£1,000	Plant hire
CP/M	Goldcrest	£300	Nominal ledger
CP/M North Star	Micromedia	£195	Vehicle maintenance
CP/M Vector	Taylor Microsystems	£495	Bill of materials
Ohio Scientific	Stratheden Ltd	£300	Statistics package
Ohio Scientific	Stratheden Ltd		Insurance brokers system
Ohio Scientific	Stratheden Ltd		Hospital package
North Star DOS	Intelligent Artifacts	£52	Parts list management and ordering
North Star Horizon	Wisbech Computer Services	£750	Double-glazing manufacturer
North Star Horizon	Wisbech Computer Services	£750	Double-glazing costs
North Star Horizon	Wisbech Computer Services	£450	Time recording
SuperBrain	Alan Pearman Ltd	£190	Statistics package
SuperBrain	Alan Pearman Ltd	£105	APL utility functions
SuperBrain	Alan Pearman Ltd	£225	APL Text editor/ processor
SuperBrain	Alan Pearman Ltd	£125	Micro-mainframe communications
SuperBrain	Alan Pearman Ltd	£490	Modelling/simulation
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SuperBrain	Alan Pearman Ltd	£380	Hard graphics copy
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Tandy TRS-80	P J Norris	£1,000	Comprehensive sales and purchase
Tandy TRS-80	Quickmet	£785	Integrated accounts package

Zilog MCZ range	Microbits	£1,000	Insurance brokers system
Zilog MCZ range	Microbits	£1,000	Production control
Zilog MCZ range	Microbits	£1,000	Bill of materials
Z-80/8080	Intereurope	£500	Conference organiser

Alphabetical list of suppliers

Supplier	Address	Sales contact
3-Line Computing 0482-445496	36 Clough Road Hull HU5 1QL	Tim Hill
ACT Microsoft Ltd 021-455-8585	Radclyffe House 66-68 Hagley Road Birmingham B16 8PF	Matthew Wauchope
Aerco-Gemsoft 04862-22881	27 Chobham Road Woking Surrey	
A J Harding (Molimerx) 0424-22039	28 Collington Avenue Bexhill-on-Sea, East Sussex	John Harding
Algobel Computers Ltd 021-233-2407	33 Cornwall Buildings Newhall Street Birmingham B3 3QR	Amanda Anders
Amplicon M S Ltd 0273-608331	Richmond Road Brighton, Sussex BN1 6JA	Peter Wood
Anagram Systems 0403-50854	60a Queens Street Horsham, West Sussex RH13 5AD	
Analog Electronics 0203-417761	47 Ridgeway Avenue Coventry	
Alan Pearman Ltd 0244-46024/21084	Maple House, Mortlake Crescent Chester CH3 5UR	
Atlanta Data Systems Ltd 01-739-5889	350/356 Old Street London EC1V 9DT	Frank Laughton
Basic Computing 0535-65094	Oakworth Road Keighley, West Yorkshire BD22 7LA	Mike Collier
Benchmark CS Ltd 0726-61000	7-8 Aylmer Square St Austell, Cornwall PL25 5LL	John Fisher
Bristol Software Factory 0272-277135	Kingsons House, Grove Avenue Queen Square, Bristol BS1 4QY	W J Kyle-Price
Business Solutions Ltd 01-554-5985/0582	1 Park Avenue, Ilford Essex IG1 4LU	S Page
Bytesoft Systems Limited 0533-531441	16 New Street Leicester LE1 5NR	David Biggins
Chess Consultancies Ltd 061-832-6792	Progress House 31-33 Mount Street, Salford Manchester M3	D G West
Cleartone ADP 0495-244555	Prince of Wales Industrial Estate Abercarn, Gwent NP1 5RJ	C J Holbrook
Clenlo Computing Services 01-653-6028	15 South View Court The Woodlands, Beulah Hill London SE19	
Commodore BM (U.K.) Ltd Slough 74111	818 Leigh Road Slough Industrial Estate Slough Berkshire	A Gould
Compfer Ltd 0772-57684	Preston Computer Centre 6 Victoria Buildings, Fishergate Preston Lancashire	
CPS (Data Systems) Ltd 021-707-3866	Arden House, 1102 Warwick Road Acocks Green Birmingham B27 6BH	
CPL (Cwmni Peirianneg Llyn Ltd) (0758) 3035	Liverpool House, Pwllheli Gwynedd LL53 5DE	L Roberts
Compsoft Ltd 0483-39665/505918	Great Tangley, Manor Farm Wonersh, Guildford, Surrey	
Comput-A-Crop 01-771-0867	32 Whitworth Road London SE25 6XH	Jenny Wilson
CPR Systems Ltd 04492-5488	37-39 Ipswich Street Stowmarket, Suffolk	Roger Taylor
Computech Systems 01-794-0202	168 Finchley Road London NW3	Laurence Payne

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EXIDY SORCEROR, 16K, as new with leads, manuals, Sorceror club newsletters, with BASIC upgrade kit not fitted. £350 ono. Mr. M. Yaacob, 9 Clare Garden, Riverside, Cardiff, Wales.

ACORN ATOM 12K + 12K, VIA, PSU, software, leads. £260. Tel: 01-531 1033.

PET 32K, new ROM, extl. cassette deck, software/books. £400 ono. Tel: 0827 873840.

ACORN ATOM 12K + 12K PSU, manual games. £230 ono. Tel: Rickmansworth 76143.

HP41C + Barcode Reader + Maths module + Solution Books. Cost £299 new. Sell £210 ono. Tel Swansea 290241.

TRS-80 48K two disc drives VDU cassette printer, 50 discs, 100 programs, books £1,050. 0752-661364 (Plymouth).

ZX81 16K. Basic line re-numbering and multi-line erasure. M/C code, cassette £3.95. M. J. Franklin, 69 The Heights, Northolt, Middx.

MZ-80K MUSIC and SOUND EFFECTS (20K), five programs, cassette, "Chipsongs" — lively jigs and reels, "Birdsongs" — millions of variations! "Engines" — quite remarkable, "Chipsong Generator" — actually composes, spontaneously! "Weird music" — demonstrates POKE and USR. All for £9. G. B. James, 21 Lamond Place, Aberdeen AB2 3UT.

HIGH RESOLUTION PACKAGE (£7.50), Music package (£6.50) for UNEXPANDED VIC. 0634 814118 for details.

KSR 33 TELETYPE with stand, excellent condition, 20mA I/O plugs straight into your Nascom etc £85. Chester 382292.

ZX81-16K GRAPHIC GAMES CASSETTES "Maze", "Defender", etc. £2. Tel: (0533) 897268.

CASIO FX702 user group £6.50/year for 6 issues of Newsletter. R. Cooper, 11 Braintree Road, Dunmow, Essex.

MZ-80K SALES program, cassette based includes invoicing, statements and VAT. Send SAE for full details to: D. M. Bellwood, 6 Barlow Rd., Sheffield, S6 5HR.

16K ZX81 for sale. Has D. K. Tronics graphic ROM. With software, it is worth £250. Bargain at £199. Phone Southend (0702) 714764.

VIDEO GENIE, 16K LII, sound, joysticks, b/w monitor, 2nd cassette. Books, manuals, software, v.g.c., £350 ono. Tel: 0234-741169

MZ-80K 48K Basic and monitor listings, Sharp ASM/Edit, £390, Deeside 810245.

PET 32K, new ROM, external large keyboard. Also QUME Sprint 55, interface, word processor software(fixed/proportional spacing). PET & QUME manuals, £1,300 ono. Tel: Chippenham 75222.

32K PET 2001 series. Integral cassette, small keyboard, old ROMs, programs, various books, sound box, etc. Little used, £425. 01-778 9932.

TANDY QUICK PRINTER II, £90, including cable, interface. David Kampfner, 4 Gresham Gardens, London NW11. 01-458 8240.

TRS-80 16K L2, screen, recorder, manuals etc. £275. Milton Keynes 670615.

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PERIPHERAL SALE: Dolphin BD80 printer 120CPS £189, also BD80P with Pet interface £210. Data Dynamics 390 RS232 printer £80. IBM 735 Selectric Terminal Printer £196. Tel: 0435-830680.

32K 380Z research machines computer. As new condition in original blue case. Buyer supplies their own ASCII keyboard. Complete with Basic software, utilities and documentation, £700. Reading (0734) 594365.

APPLE II + 48K with disk drive and controller, colour card, Alf MC16 music synthesiser with software and manual, various software, £1,200 ono. Tel: (0329) 232698.

APPLE II PLUS 48K, colour card, over £60 software, cassette player, 5 manuals, all leads, modulator, paddles, only six months old, PERFECT CONDITION, still under warranty only £695. Phone Uxbridge (0895) 35129.

ZX81, 16 xK RAM, 30 Programs + M/C Lang. Books, Motherboard kit. Real lost £145, will accept £125 ono. (still under guarantee) Tel: 01-898 4863.

APPLE. Educational Software for Primary Schools. Interesting game settings. Excellent graphics, presentation, documentation. Discs or cassettes (£5-£8 each). Details/Catalogue from Kingfisher Software. Tel: 02756 68152.

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10 1K ZX81 GAMES-M/C = Canyon!, Shuttle, Asteroids. BASIC = Galaxians, Simon, Space Invasion, Connection, Destroyer, Hangman, Gunfight. Cassette £2.50 Listings £3.00 c.w.o. Ian Morrison, 17 Winton Circus, Saltcoats, Ayrshire KA21 5DA.

DO YOU WRITE MACHINE CODE on the backs of envelopes? Pad of 80 coding sheets £2.40 inc. p&p. Toseland, 30 Torrs Road, Harrogate HG1 4TB.

ZX81 FAST ACTION top quality 4K machine code programs. Scramble, Galaxy Invaders, Space Invaders, Gunfight, Asteroids. £3.95 per program on tape. J. Steadman, 6 Carron Close, Leighton Buzzard, Beds., LU7 7XB.

TANDY LINE PRINTER VII, only a few months old, still guaranteed. Will accept £179. Tel: 021-358 5312.

SHARP MZ80K Education Software, calorimetry £5. Galvonometers £5. Gas Laws £5, German Vocabulary Test (2 volumes) £7.50 per volume. Send for full details to QUALITY SOFTWARE, 21 Dunes Drive, Formby, Merseyside L37 1PE.

NASCOM 2. 64K in cased rack. RamA + RamB, 4MHz no-watts, Programmable graphics, Sound, ROM Basic, ROM Toolkit, Pascal, Pilot, Forth, Assembler, Games etc. Basic & Toolkit may be paged out to give 62K useable RAM. Phone Nigel Edwards 0202-8753210.

SHARP MZ80K 48K, 18 months old, reset switch, MX80FT Interface, user notes, and £200 worth software. Includes Calc II, Database, Supercopy, Printer Basic, Extended Basic, Star Trek, Word Processor, Space Invaders, Disassembler, Sound Effects, M/C Code and Chess. Deliver 30 miles Luton. Nearest £420. Drek (0582) 418577 (evenings) 666678 (days).

COMPUTER GAMES — five home-produced games available (strictly non-arcade type) for 16K TRS-80. S.A.E. for details to: 57 Rowley Street, Walsall WS1 2AZ.

CSC (Northern Ltd) (0274) 391076	"Ash Court", 2 Ash Grove Great Horton Road, Bradford BD7 1BN	Stewart Smith
CSM Ltd 021-382-4171	Refuge Assurance House Sutton New Road, Birmingham	Peter Mart
Cyderpress Ltd 0491-37769	2 Church Lane Wallingford, Oxfordshire	C Murphy
Daman Computer Services 061-793-7015	Kennedy House, Rutland Street Swinton, Manchester M27 2AU	L J Watson
P R Daly 09274-29815	Oaklands Gate, Northwood Middlesex HA6 3AA	Peter Daly
Deltic Computing Ltd Basingstoke 59715	2nd Floor, May Place House May Place, Basingstoke, Hampshire	
Diskdean Ltd 01-242-7394	23 Bedford Row London WC1R 4EB	
Diskwise Ltd 05793-3780	25 Fore Street Callington, Cornwall	R Cornforth
D T Systems (0603) 27833	32 Surrey Street, Norwich NR1 3NY	
Equinox Computer Systems 01-739-2387/9	Kleeman House, 16 Anning Street New Inn Yard, London EC2	M Kusmirak
Fully Integrated Business Systems Ltd 021-328-7920	18 Hanover Drive Gravelly Industrial Park Tyburn Road, Birmingham B24 8TE	John Metcalf
Goldcrest Computer Services Newport Pagnell 613188/611988	67 Union Street, Newport Pagnell Buckinghamshire	C Hartnett
G W Computers Ltd 01-636-8210	89 Bedford Court Mansions Bedford Avenue, London WC1	
Graffcom Systems Ltd	52 Shaftesbury Avenue London	Barbara Castedine
Graham Dorian Software 01-379-7931	c/o Lifeboat Associates 32 Neal Street, London WC2H 9PS	
Guestel Ltd 0225-65379	Refuge House 2-4 Henry Street, Bath	Allan Timpany
Hayden Young Ltd 01-387-4377	PO Box 117, 141 Euston Road London NW1 2AY	
Haywood Associates Ltd 01-428-9831	11 Station Approach Northwood, Middlesex	
HB Computers Ltd 0536-520910	22 Newland Street Kettering, Northamptonshire	Johnny Johnson
Horizon Software Ltd 0533-556550	Regent House, 16 West Walk Leicester LE1 7NG	
Humac Ltd Romford 752005	168-186 South Street Romford, Essex RM1 1TR	John Oatham
IBIS Business Information Systems Ltd. 061-881 0585	Pargate House, Cross Road, Chorlton-cum-Hardy, Manchester M21 1DH	F Brown
Informex London Ltd 01-318-4213/7	8-12 Lee High Road London SE13 5LQ	
Instar Business Systems 01-680-5330	61 High Street Croydon, Surrey	
Intelligent Artefacts 0223-207689	Cambridge Road Orwell, Hertfordshire	
Intereurope SD Ltd 0734-789183	19-21 Denmark Street Wokingham, Berkshire RG11 2QX	
Interface Computer Services Ltd 0376-518112	First Floor, 17 Guithavon Street Witham, Essex	
Ismail CAD	47a St Johns Road, Tottenham, London N15	O Ismail
James C Steedman 0903-814923	18 Manor Road, Upper Beeding Steyning, Sussex	
Keen Computers 0602-583254	5b The Poultry Nottingham	Bob Ellis
Kesho Systems 041-226-4236	72 Waterloo Street Glasgow G2	Angus Nial

L & J Computers 01-204-7525	3 Crundale Avenue Kingsbury, London NW9 9PJ	Jack Goodman
Landsler Software 01-399-2476/7	29a Tolworth Park Road Surbiton, Surrey KT6 7RL	E Landsler
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Logma Systems Design Bolton 389854	2-10 Bradshawgate Bolton, Lancashire	
Ludhouse Ltd 01-679-4321	2-6 Marian Road London SW16 5HR	M Ward
Map Computer Systems Ltd 01-633-3084/5	Belgrave Industrial Estate Honeywell Lane, Oldham OL8 2LY	Denis Thomson
Median-Tec 0734-664969	120 Oxford Road Reading, Berkshire	
Metrotech 0895-58111	Waterloo Road Uxbridge, Middlesex UB8 2YW	
Micro Computation 01-882-5104	8 Station Parade Southgate, London N14	
Micro Focus	c/o Lifeboat Associates 32 Neal Street, London WC2	
Microact Ltd 021-455-8585	Radclyffe House 66-68 Hagley Road, Edgbaston Birmingham	
Microbits 0734-792021	Barford House, Shute End Wokingham Berkshire RG11 1BJ	
Microcomputer Applications 0734-470425	11 Riverside Court Caversham, Reading Berkshire	
Microcomputer BM 01-981-3993	4 Morgan Street London E3 5AB	
Microdigital Ltd 051-227-2535	25 Brunswick Street Liverpool L2 0BJ	Graham Jones
Microgems Software 0602-275559	32 Buckingham Avenue Hucknall, Nottinghamshire	
Microland 0723-70715	17 Victoria Road Scarborough, North Yorkshire	
Micromedia Systems Newport 59276/7	Seymour House 14-16 Chepstow Road Newport, Gwent	
Micropute 0625-612818	Communique Place 9 Prestbury Place Macclesfield, Cheshire	
Microsense 0442-41191/48151	Finway Road Hemel Hempstead Hertfordshire	
Microtek 0689-26803	50 Chislehurst Road Orpington, Kent	
Minicomputer CS Ltd 0494-448686	Pilot Trading Estate 163 West Wycombe Road High Wycombe Buckinghamshire	
MMS Computer Systems 0234-40601	26 Mill Street Bedford	
P J Norris Computer Applications 053-183-428	Rochester House, Canon Frome Ledbury, Herefordshire HR8 2TG	P J Norris
Padmede Computer Services 025-671-2434	112/116 High Street Odiham, Basingstoke Hampshire	John Packwood
PCL Software Ltd 021-552-6126	146-150 Birchfield Lane Oldbury, Warley West Midlands B69 2AY	P Hemmings
Peach Data Services Ltd 0283-44968	5 Horninglow Street Burton on Trent DE14 1NJ	Brian Homewood
Personal Computers Ltd 01-626-8121/2/3	194-200 Bishopsgate London EC4M 4NR	Mike Hardwick
PK Microsystems Ltd 01-839-3143	46-47 Pall Mall London SW1Y 5JG	

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APPLE GRAPHICS TABLAT complete, unused not needed on project. £380. Tel: 0225 310916.

SINCLAIR ZX81 16K RAM PACK — almost new — £42 o.n.o. Bedford (0234) 857105.

ZX81 DATA: provides read, data and restore statements (integral data values only). Cassette £2.50. ACCOUNTS — budget your domestic or business spending. Saves datafiles separately from program. Cassette (16K) £3.45. A. N. Wilson, The Vicarage, Whitworth Square, Rochdale, Lancs., OL12 8PY.

ZX81 16K STOCK ANALYSIS PROGRAM: Menu driven, user-definable, gives results of stock used, gross profit compares stock holdings and gives graphic display of results. Ideal for restaurant, small shop, pub, small hotel, etc. Only £3.75 on cassette. J. Lavelle, Windy Hill, Far Westhouse, Ingleton, Yorkshire LA6 3NR.

ZX81 1K THE ULTIMATE GAMES TAPE: 20 IK games for only £3.75 on cassette. Includes: reaction, pontoon, shoot out, bomber, and many more. J. Lavelle, Windy Hill, Far Westhouse, Ingleton, Yorkshire LA6 3NR.

6800-1-2-3-8 ASSEMBLER. Runs on CBM PET. Fast 2 pass macro-assembler. Interface to Davidson-Richards Eprom programmer. SAE further details. CWO. Manual £2. Disc £28. M. Tyler, 2 Park View Drive, Cashes Green, Stroud, Glos. GL5 4NQ.

COMMODORE PET 8050 complete with accounting system and data base — less than 6 months old £2,250.00
COMMODORE PET 8050 complete with accounting system only 18 months old £1,500.00. Tel: 0963 62797 for further details.

TELEVIDEO TS801 64K IMB floppy CP/M computer 6 months old very good condition. £1,950. Diablo 630 daisy wheel 9 months old, fully maintained, £1,100. Sanders Technology 12/7 printer with sheet feeder and 5 fonts, 9 months old, £2,300. Tel: 0273 722240 anytime.

Z80A, 5MHZ, 64K, twin 5" DS-DD drives & controller, Serial/Parallel I/O, S100 bus & power, with 24 x 80 VDU board, 180 c.p.s. Matrix printer, and system case. Running demo but needs building into its box. All software, discs, listings, manuals, circuits etc. Total cost £2,500 + £200 worth of good technical stuff thrown in free. Only needs £100 video monitor & keyboard to complete. Bargain £1,500 lot. St. Albans 64077 evenings/weekends.

OSI C2-4P, 8K RAM, 300/4.8K Baud cassette, 32 x 64/32 x 32 display. Expansion bus, sound, d/a port, good graphics. £199. Ashby-de-la-Zouch (Leics.) 411146.

TRS-80 . . . 16K, L2, monitor, cassette, manuals. All as new, only 8 months old. (Buying house) hence only £290. Tel: Burton-on-Trent 65779.

PAPER TIGER IDS 560 letter quality Matrix printer virtually unused £800. Tel: 01-286 0071.

YOUR TRS-80/VIDEO GENIE program listing printed, 50p per sheet (63 lines) on high quality fanfold paper or 50p per 100 lines on unperforated roll paper. Minimum order £1.00, your tapes/discs returned post free. Cheque/PO to Dave Ingledew, 20, Embsay Rd., Lower Swanwick, Southampton.

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8K SYM working TELETYPE, resident assembler editor, fast Basic, super monitor. Excellent keyboard QWERTY and Hex £2.50. Tel: 0386 3148.

NASCOM 2, 32K RAM, NAS/Graphics ROM, 8K BASIC, 3 Amp PSU. Complete with manual, portable TV and cassette recorder — £350 ono. Tel: 06286 5505.

MZ80K USERS. 'COPY PROGRAM', copies any software from monitor £6. 'SPACE ATTACK' (knight's forth) fast graphics £4, or both programs £8. P. Massey, 61 Green Avenue, Astley, Manchester M29 7FF.

SHARP MZ-80K "Championship Tables" — motivational game devised by Maths Specialist encourages speed and accuracy. Satisfaction assured. Cassette £4.00 (6K BASIC). P. Downes, 11 Melbury Grove, Birmingham B14 6BN.

ZX81, 16K MOVING GRAPHIC GAMES 10 challenging, flicker-free games with instructions. CASSETTE 1: Golf (with fairways, greens and scoreboard), Lunar landing, Fighter Pilot, Meteor, Alien Invaders. CASSETTE 2: Galaxy Guardian, Gridfire, Cosmic Fighter, Superlander, Shootout. One cassette: £4.99. Both cassettes £7.99. From I. Beynon, 33 The Chase, ROMFORD, RM1 4BE.

APPLE II OWNERS — Protect your software with this 16 sector DOS compatible system. Operates like a normal disk until a secret word is typed in — then secret programs can be stored and recalled! ONLY £10. Mr. D. Fenton, 62 Chester Rd, Huntington, Chester, CH3 6BT.

16K ZX81, with printer and cassette recorder £150. Write Booth, 72 Sleaford House, Blackthorn St., London E3.

HITACHI 9" MONITOR, £75. Philips N2234 cassette recorder with counter £30. Tel: (064 73) 3456.

APPLE 48K DISC 3.3, parallel interface, RF mod, word processor, utilities, games and discs, £950. Woking (04862) 70890.

VIC-20, BASIC SYSTEM, computer and cassette. As new, only £169. Genuine reason for sale. Ask for Simon; Maidstone (0622) 812385.

VIC: TWO CASSETTES AVAILABLE, 1 for £5 or both for £8. Each has 6 programs. SAE, G. Quaglia, 232 Shoebury Road, Thorpe Bay, Essex.

PET 2001 8K: £350. Only used occasionally and then mainly for computer games. Buyer collects. Tel: (evenings) Middlesbrough 591656.

TAPE OF VIC SOFTWARE with catalogue listing games and DS VIC BASIC. Adds over 40 commands! Send £1 to DS Software, 19 Reddings, Welwyn Garden City, Herts.

ZX80/81 16K "WORDMASTER". Over 2000 4-letter words. Absorbing and educational. Tape £2.25. State 4K/8K ROM. F. Manders, 24 Horton St., Lincoln LN2 5NG.

ANYONE HAVE AN ATARI 400 or 800 to swap for Hi-Fi system (with possible cash adjustment). Hi-Fi consists of Aiwa front loading cassette, AD6300 Dolby/Metal/CRO² JVC amp JAS11 30 watts RMS per channel. Philips deck, Solavox speakers, Akai reel to reel 2 speed with Dolby.

P R Daly & Co Ltd 01-868-7284	Butts Mead, High Road, Eastcote Pinner Middlesex HA5 2EY	
Quickmet Software Development 0202-888217	57 Leigh Road, Wimborne Dorset BH21 1AE	I Metcalf
Research Resources Ltd 07073-26633	40 Stonehills Welwyn Garden City Hertfordshire	
Rockliff Brothers Ltd 051-521-5830	2 Rumford Street Liverpool L2 8SZ	M Taylor
SA Systems Newbury 45813	Allington Lodge, Round End Newbury, Berkshire RG14 6PL	S A Trinder
Salmon Microcomputing 0325-721368	PO Box 26 Croft-on-Tees Darlington DL2 2TN	S J A Still
SBD Consultants Ltd 01-940-5194	15 Jocellyn Road Richmond, Surrey TW9 2TJ	Susan Ben-David
Selven Ltd 0376-40900	West House Chambers 3 Sandpit Road Braintree, Essex CM7 7LY	R Crowther
Sheffield MIS Ltd 0742-20224	77 Hallam Grange Rise Sheffield S10 4BE	R A Coates
SMG Microcomputers Gravesend 55813	39 Windmill Street Gravesend, Kent	
Software Aids International Ltd 01-204-9396	14 Chapman Crescent Kenton Harrow, Middlesex	David Bull
Software Architects Ltd 01-734-9402	34/35 Dean Street London W1V 5AP	
Solitaire Ltd 04252-71448	Highcliff House 411-413 Lymington Road Highcliff, Dorset BH23 5EN	
Southdata Ltd 01-994-6477	10 Barley Mow Passage London W4	
Southern Computer Systems Torquay 212957/8	7 Park Hill Road, Torquay, Devon	Richard White
Stage One Computers Ltd 0202-23570	6 Criterion Arcade Old Christchurch Road Bournemouth	N Hewitt
Stratheden Ltd 0624-26668/25639	Exchange House, 54 Athol Street Douglas, Isle of Man	P Bridson
Style Systems Ltd 0254-71638	28a Railway Road Darwen, Lancashire BB3 2RG	R Horman
SWTPC Ltd 01-491-7507	38 Dover Street London W1	
Systematics International Ltd 0268-284601	Essex House, Cherrydown Basildon, Essex	R Young
T & V Johnson Ltd 0276-62506	165 London Road Camberley, Surrey GU15 3JS	T Johnson
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Taylor Micro Systems 021-358-2436	Hamstead Industrial Estate Old Walsall Road, Great Barr Birmingham	C A Taylor
The Alphabet Company 03046-7209	2 Whitefriars Way, Sandwich Kent CT13 9AD	A L Minter
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Vlasak Electronics Ltd 0494-448633	Vlasak House, Stuart Road High Wycombe, Buckinghamshire HP13 6AG	Paul Vlasak
Wisbech Computer Services (0945) 64146	10 Market Street, Wisbech Cambridgeshire PE13 1EX	Ian Duffy
Xitan Systems Ltd 0703-38740	23 Cumberland Place Southampton	

STARFIGHTER

Mercenaries — the Solar Galactic Authority needs you. Bob Collman reviews this buccaneering space game from *The War Machine*.

THE GAME of Starfighter is written in machine code, with sound, for the TRS-80 Level 2, 16K, Models 1 or 3. With the tapes containing the program you receive a 32-page instruction manual entitled *SC-78503 Starfighter — New Pilot Induction Manual.* You will notice it is produced by "SGA Periodicals Office/Landbase Central — Printing: 5E". The manual is issued to all new Starfighter pilots and not only gives complete specifications for the SC-78503 and the operation of the "TRS-type control console" but also brings the trainee up to date in the political environment, conditions of service, handling of service records — saving games on tape, to you — and gives details of enemy and friendly craft likely to be encountered. There is also a section on combat tactics.

You will either love or hate the manual. If you have read much science fiction you will be able to skim over the pseudo-science to reach the information, and in the process begin to feel like a rookie Starfighter pilot. If you merely want a set of rules, you will find them all in the manual but will have to hunt through mountains of verbiage: "As an aid to target identification, the SC-78503 incorporates a target outline display for targets directly in front of the craft. The operation of craft display is a comparative process which produces an arbitrary screen display". I have to admit that I found it good fun, and as much a part of the game as the program itself.

Two tapes are supplied. The first is a training program called a "combat simulator", with which you can fly missions against any and all types of craft you are likely to meet. It will notify you of pilot errors. You can also request a list of all available controls or stop the action. The complexity of piloting an SC-78503 makes the pilot trainer extremely useful.

Starfighter pilots are hired as mercenaries by the Solar Galactic Authority, a company locked in war with the Petro Resource Conglomerate. Pilots are assigned to patrol particular sectors of space, with difficulty based on rank, and are to investigate all sightings. This would not be all that difficult if it were not for the fact that many of the encounters are with friendly star merchants, other Starfighters, beacons, debris, etc.

Shooting at your friends is penalised, and rightly so, and trying to tell friend from foe can be very nerve-racking. Unfortunately, some merchants are actually pirates and some Starfighters are actually rogues in business for themselves. The SC-87503 has an identification device, but this only works at very close range and can be jammed. Investigating a sighting too aggressively can cause even friendlies to open fire.

I fired until I heard his hypercharge field collapsing.

As a mercenary, the Starfighter pilot is expected to collect enough bounty on legal kills to pay for the manoeuvring fuel, the hypercharge which is used for long jumps, weapons and screens, and tow tickets which you need if you are left stranded in space due to damage or lack of hypercharge. To gain promotion you can only claim kills that have not been declared for bounty — an interesting problem.

After launch from Landbase Central I found myself in an empty sector with only stars showing on the viewscreen. I used the Long-Distance Target Scan to find a possible sighting, played it sneaky by shutting off my identity beacon, and hit drive. Hyperdrive booted me into another sector, and I quickly switched to combat mode and flicked on targeting which allowed me to line up my screen with whatever was in the sector.

The display panel showed the range and axis of the target; this one was 22,000 distance units away — the scale of distance units is classified — and the axis was constantly changing since the target was taking evading action. At this distance it was merely a large dot. No messages were incoming, and range was constant so I triggered a request for identification. The target did not respond and I decided to close the range in order to make a positive ID and use the manoeuvring jets.

As I closed in I decided that if combat occurred it would probably be at long range, so I switched on the beam weapon — range 3,500 — rather than the wave weapon which has a range 500 but does more damage.

As I closed in, the target began to evade violently and signalled me that it was a SC-87503 Starfighter. Not knowing whose side he was on I left my signal beacon off and continued to close range, hoping to use my identification device which checks the target's tactics, brand of fuel, etc., and identifies a target as friend or foe.

The target turned towards me and the distance closed rapidly. He was continuing to signal, which jammed my equipment and we flashed past each other. I noted he had begun to turn on to my tail and I was going too fast to turn with him. Even though I cut my speed I was still unable to get him on to the viewscreen and my identification device finally signalled

'IDENTIFIED . . . MARAUDER
Attack!

Too damned late! Wham! He had opened fire and I could not get him into target lock.

I hit maximum acceleration, hoping to open the range. Wham! I could not take much more of this and opened fire wildly to distract his attention. He let up as I moved out of range, but I was still unable to turn inside him. I cut my speed completely, turned as quickly as possible and managed to catch him in target lock as he flashed by.

I upped my speed, and as the range closed, I held down the target lock so that my SC-87503 followed him automatically. I opened fire and held down the firing button until I heard the lovely sound of his hypercharge field collapsing. After the debris cleared my panel warned me that my hypercharge field was running low.

One combat and I already need a recharge; but then I am lucky to be here at all. If I had not begun the mission with a full charge, I'd be in trouble now.

I would tell you more, but I'm due for launch in 10 minutes.

The War Machine is published monthly by Emjay, 17 Langbank Ave, Rise Park, Nottingham, NG5 5BU. £1.25 an issue, £13 for an annual subscription, postage and packing included.

Conclusions

- Starfighter is a state-of-the art game for the 16K TRS-80.
- The game has some arcade features but the opponents behave in a varied and intelligent manner. It should appeal even if you do not usually enjoy solo games.
- There are no apparent bugs in the program and it loaded easily.
- It is simple to save a game in progress, which is necessary if you ever work your way up the ranks to the status of Starlord.
- The graphics are excellent, considering the TRS-80's limitations, and the sound adds greatly to the fun and feeling of excitement.
- **Ratings:**

Physical quality	**Very good**
Perceived complexity	**Fairly high**
Subject complexity	**Fairly high**
Realism	**Very good**
Play balance	**Demanding**
Overall	**Excellent**

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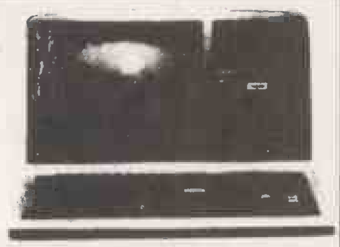

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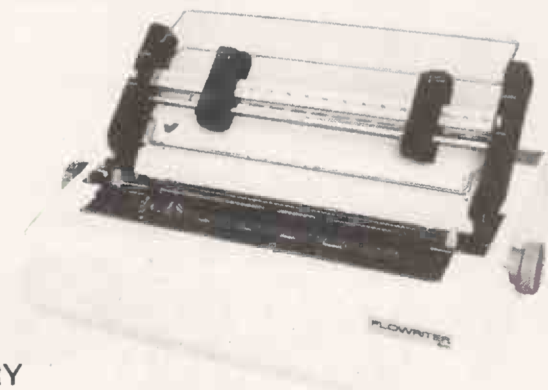

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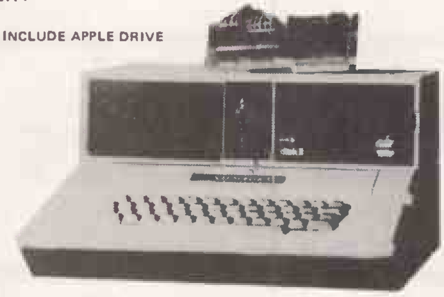

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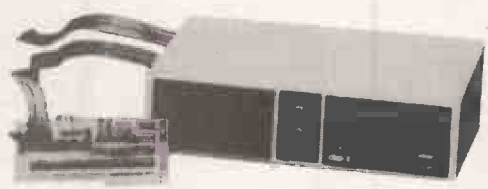

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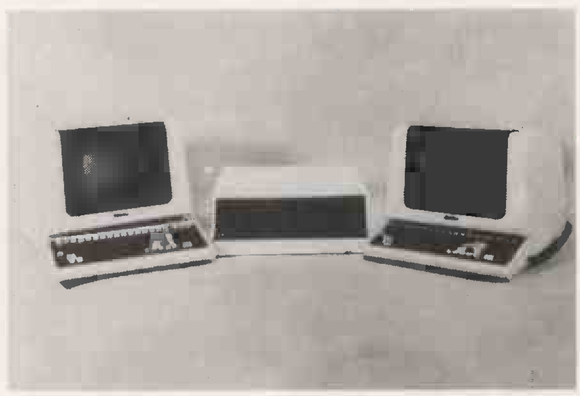

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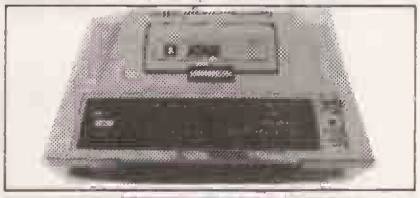

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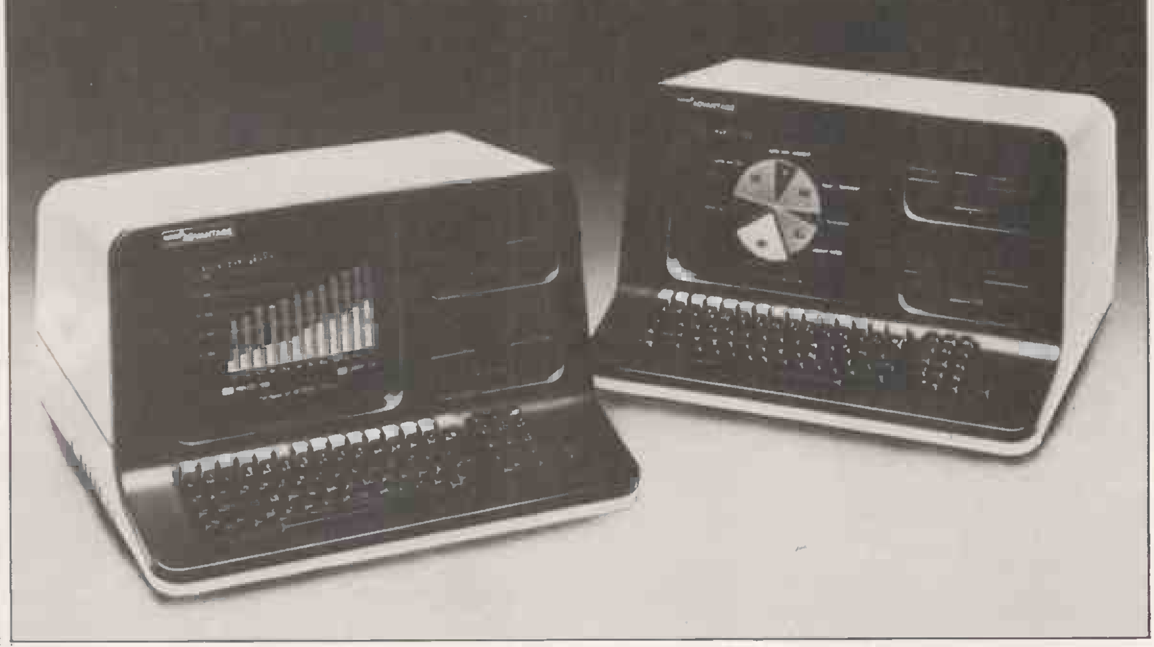

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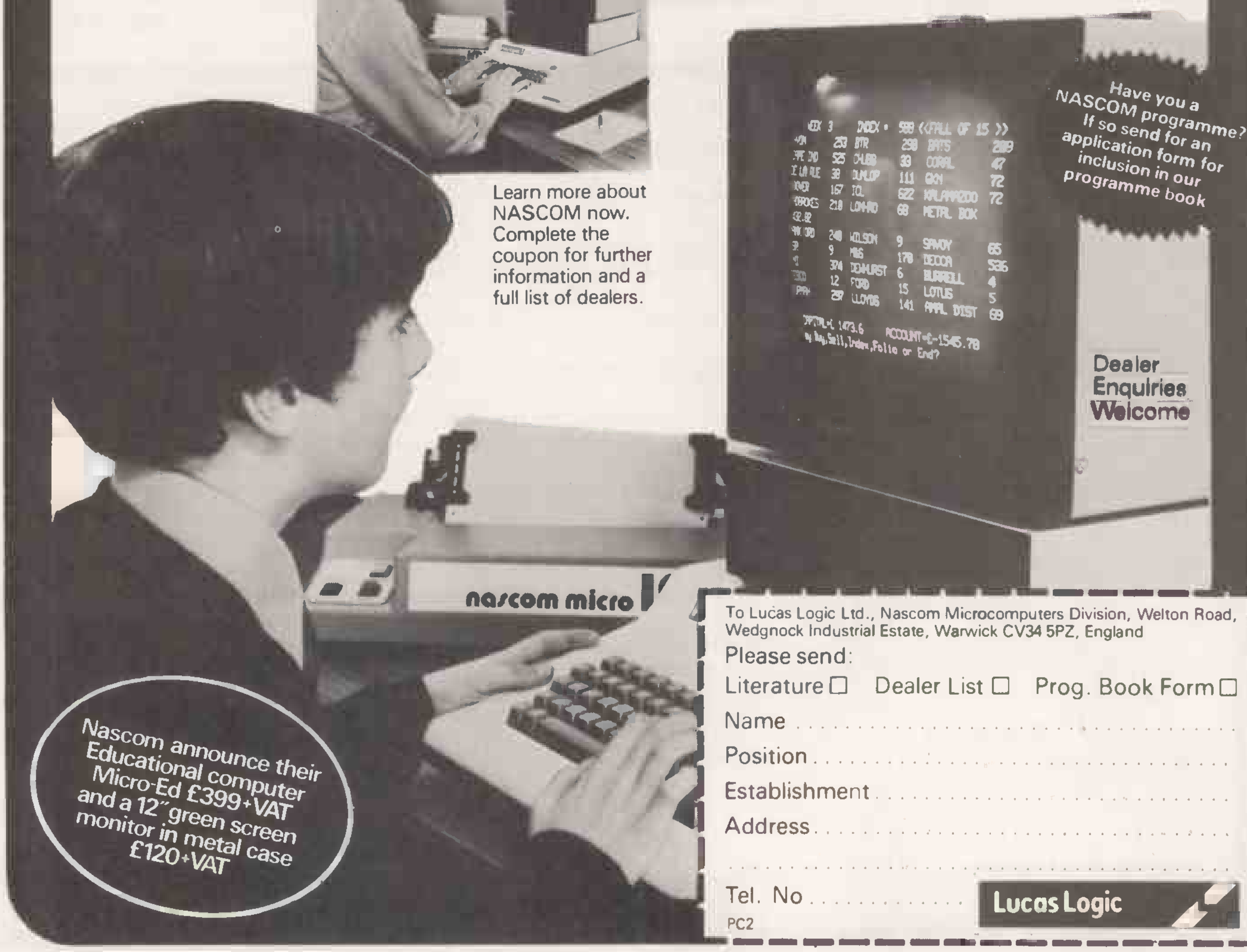

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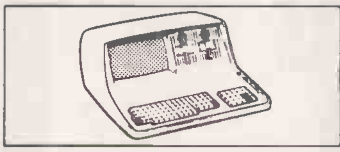

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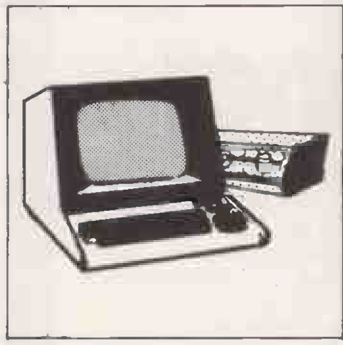

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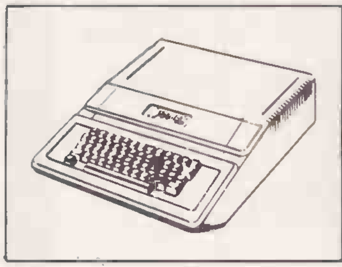

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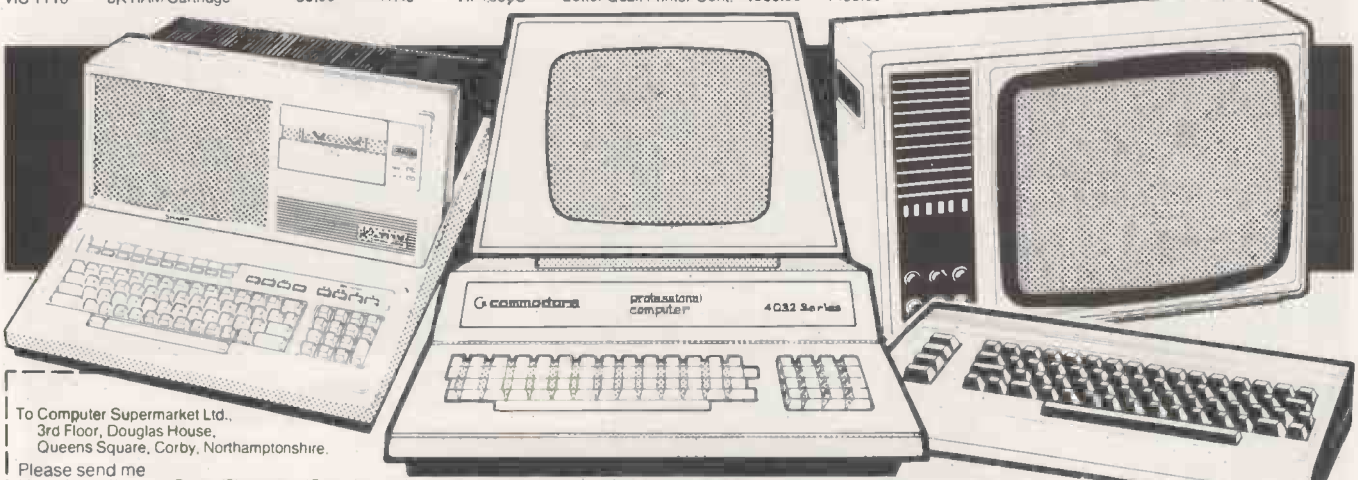

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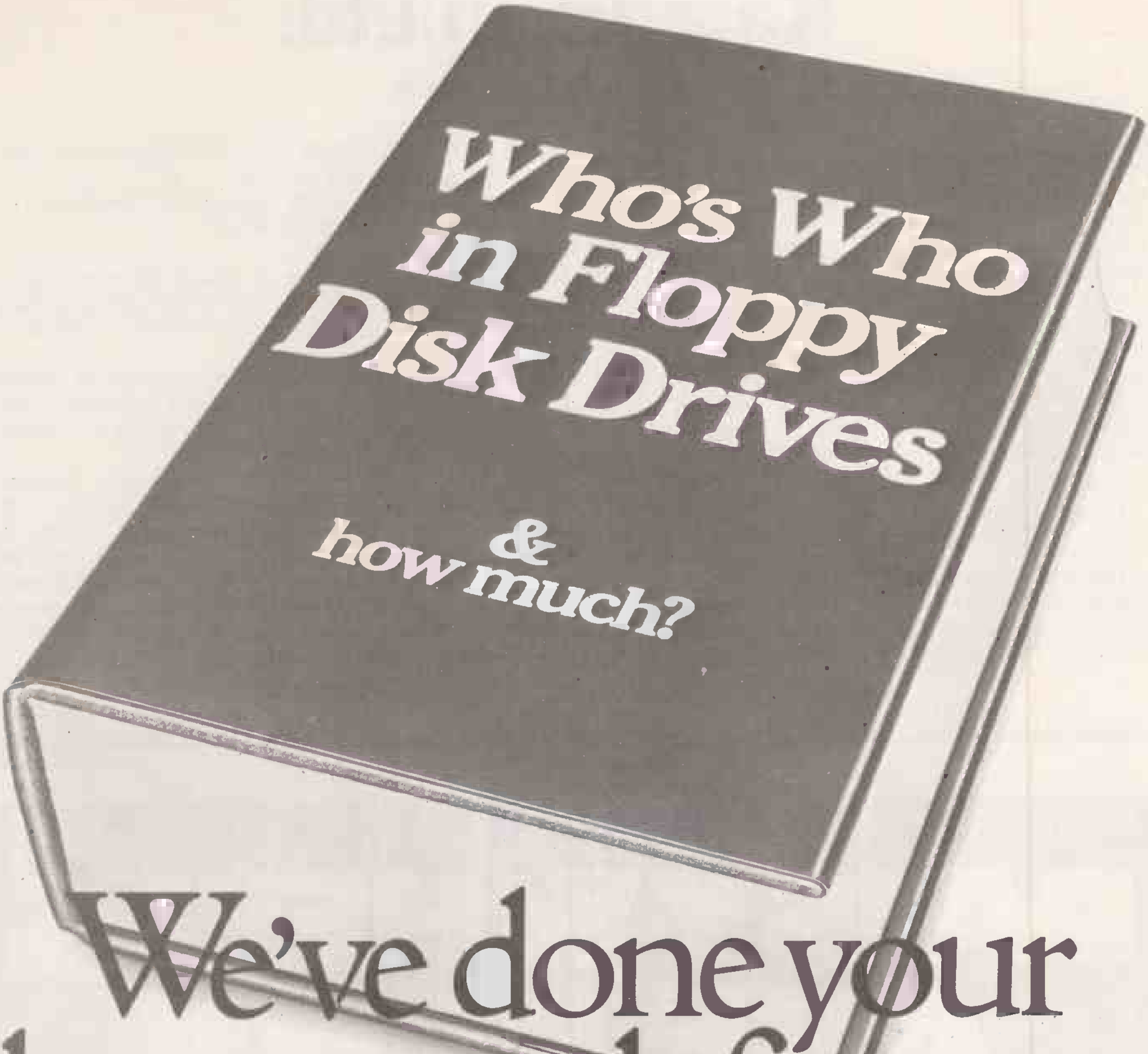

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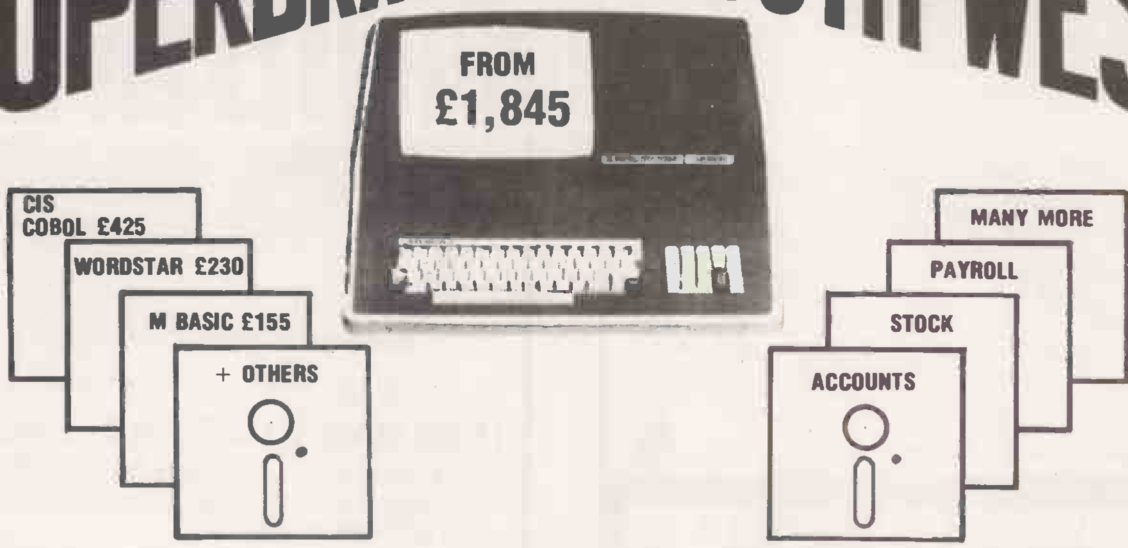

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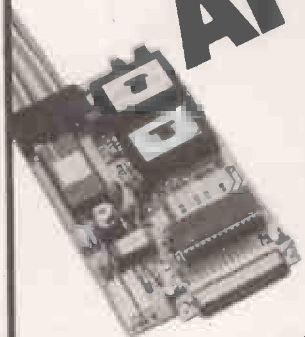

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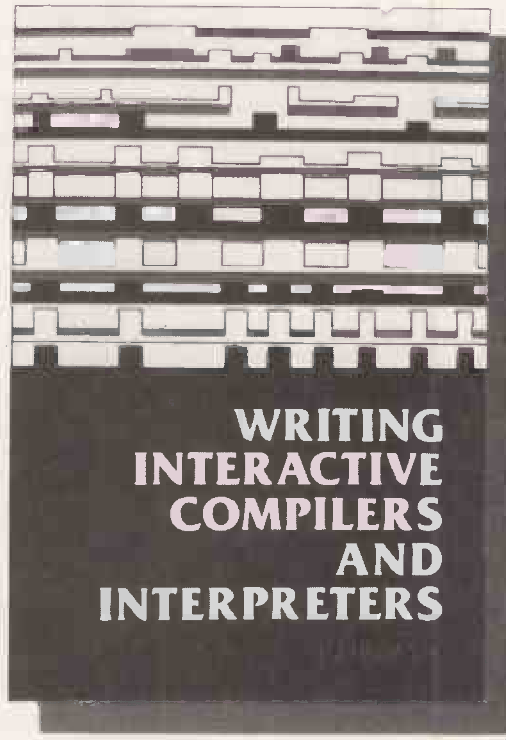

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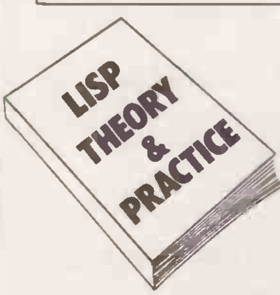

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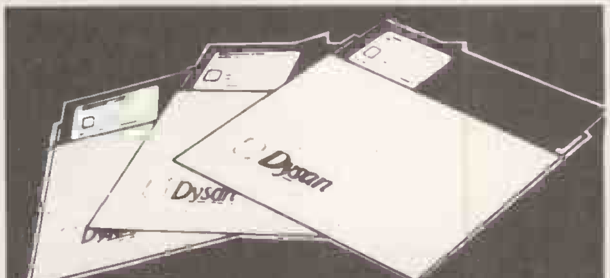

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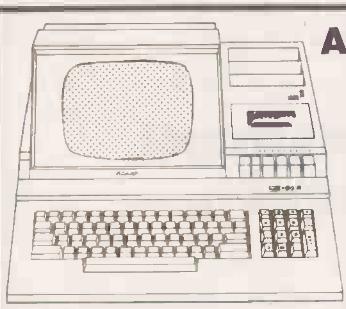

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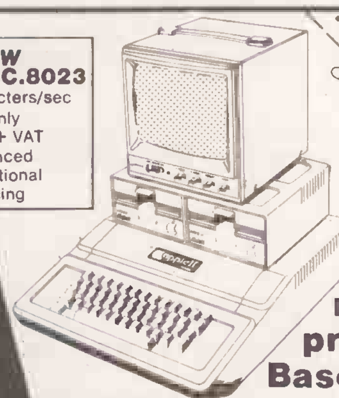

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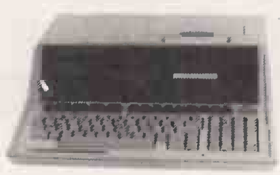

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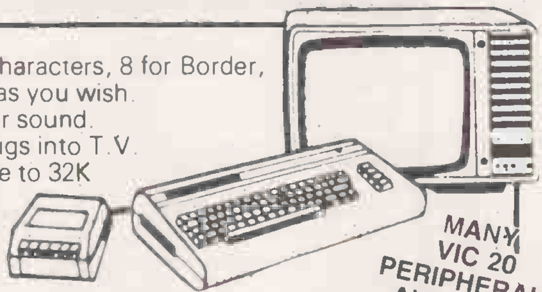

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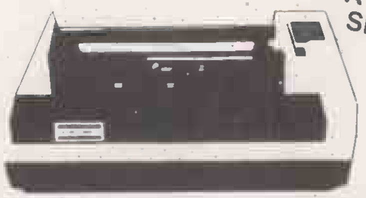

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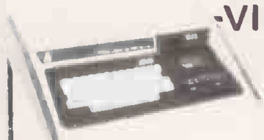

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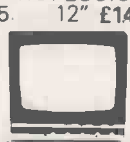

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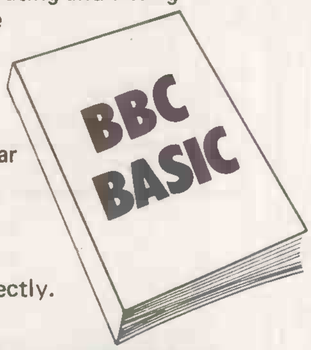

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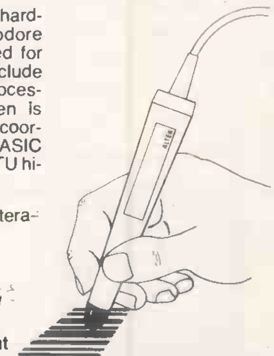

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